UNIVERSITY OF CALIFORNIA.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

168-177 POTTER BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T. COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.

WM. A. ROSENBAUM, Editor Patent Department.

WALTER T. HUNT, Advertising Department.

New England Office, 8 Cook Building, Boston.
W. IRVING BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.
W. A. NICHOLS, Manager.

Philadelphia Office, 31 City Trust Building.
EDWIN F. CLARKE, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Including Postage in the U. S., Canada or Mexico.)

IN CLUBS of four or more, $2.50 a year each; with a free extra copy to the getter up of a club of 8. Foreign subscription, $5 a year.

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **SIXTEEN YEARS AGO, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the LARGEST CIRCULATION of any electrical periodical in the world, and is the BEST ADVERTISING MEDIUM.**

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished.
For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.
Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Subscriptions and communications relating to **advertising** or the **business department** should be addressed to

THE W. J. JOHNSTON COMPANY, Ltd.,
Potter Building, New York,
OR ANY OF THE BRANCH OFFICES.

VOL. XIII. NEW YORK, APRIL 20, 1889. No. 16.

CONTENTS.

PAGE.

ILLUSTRATED ARTICLES:
Smith's Novel Electric Meter ... 228
The Pritchard Electric Water Wheel Governor ... 229
A New Daft Electric Street Car ... 229
The New Weston Tangent Galvanometer ... 230
Operating the Bridgeport, Conn., Drawbridge by Electric Motor ... 231
Measuring Self-Induction by Means of Ayrton & Perry's Secohmmeter ... 232
New Apparatus of the Bernstein Electric Company ... 233
The "National Galvanic" Open Circuit Battery ... 234
The Magnolia Anti-Friction Metal ... 234
The New Westinghouse Compound Engine ... 235
Preparing for the Great Exposition in Paris (Eiffel Tower). By E. W. H. ... 236

NEW BOOKS:
"Special Apparate Fuer Elektrische Buehnen-Beleuchtung.." ... 228
"Ancient and Modern Light-Houses." By D. P. Heap ... 228
"The Voltaic Accumulator." By E. Reynier; translated by J. Berly ... 228

CORRESPONDENCE:
Enamel Insulation for Dynamos. By B. Bidwell ... 228
A Question of Absolute and Relative Standard. By "X." ... 231
The Superiority of Hemp-Covered Cables for Deep Sea Work. By S. Trott and F. A. Hamilton ... 233

EDITORIAL:
Paragraphs ... 227

MISCELLANEOUS:
Standard Rules for Wiring Buildings. By C. H. Crockett ... 228
German Central Electric Lighting Stations ... 229
The Liquefaction of Gases by Electricity ... 229
The Rotation of the Plane of Polarization of Light by the Discharge of a Leyden Jar ... 230
Testing Chain Cables by Electric Light ... 230
Relative Amount of Voltaic Energy of Dissolved Chemical Compounds. By Dr. G. Gore ... 232
Medical Electricity ... 232
The Neyreneuf Electric Valve ... 233
Telephonic Communication in Paris ... 233
Mr. Webster's Electrolytic Treatment of Sewage ... 233
Tangent Function Multipliers to be used with the Kapp Formulæ in the Design of Dynamos and Motors. By A. T. Snell ... 234
The "Edco" Storage Car in Philadelphia ... 234
Western Union Wires to Come Down ... 234
Proposed Electrical Executions in Ohio. By A. R. Foote ... 236

SPECIAL CORRESPONDENCE:
New York Notes, 237; New England Notes, 238; Philadelphia Notes, 238; Western Notes ... 238

DEPARTMENTS:
The Telegraph, 239; The Telephone, 239; The Electric Light, 239; Applications of Power, 239; Miscellaneous Notes, 239; Personals, 239; Business Notices ... 239
Our Illustrated Record of Electrical Patents ... 240

NOTICE OF REMOVAL.

Notice is hereby given that in order to obtain greater facilities for the various departments of the business, THE ELECTRICAL WORLD will remove on May 1 from 168-177 Potter Building to an extensive suite of rooms on the ninth floor of the new "Times" Building, next door, and immediately overlooking Park Row, City Hall Square and Nassau street.

THE W. J. JOHNSTON COMPANY, LTD.

Purifying Sewage. THE Webster method of purifying sewage by electricity has already been described in these columns, and our readers will therefore be interested in the statements from England as to the successful results of recent experiments there with the process. Our London correspondent, having himself witnessed the process in operation, is satisfied as to its promise, and the description he gives shows that there is good reason for hopefulness as to this recent application.

Measuring Self-Induction. THE use of apparatus involving the employment of rapidly varying currents, such as alternate current dynamos, transformers, and the like, makes some instrument by which the self-induction of the apparatus may be determined of special value at this time. The description of the secohmmeter of Profs. Ayrton and Perry, with the methods of using it, will, we are certain, interest many of our readers. The apparatus was noticed by us some time since, but this is the first time that instructions for handling have appeared.

The Eiffel Tower. THE great Eiffel tower, which will be one of the leading and most interesting features of the approaching Paris Exposition, was "opened" a few days ago. This tower reaches a height of 1,000 feet, and is to have arc lights in its beacon, so that an opportunity will be presented for some novel experiments in candle-power values, range of illumination, etc. The use of electricity deserves comment more particularly for the reason that it is the only illuminating agent that could be employed for the work. Gas and oil alike would be failures at such an altitude, whereas the current for the arcs, generated perhaps a mile away, will be led up to the arc lamps by small wires entirely invisible.

Electric Motor Service. WE illustrate in this issue a very interesting and successful application of the electric motor to the swinging of drawbridges. The work done at Bridgeport presented difficulties which have been ingeniously met, and we have no doubt that this installation will be followed by many others of a similar nature. This is but one of the countless methods in which the electric motor can be employed to advantage. Another of the signs of the times is the announcement that the New York *World* in its new building will introduce separate electric motors for each press. In this way there will be no belt or shafting to entangle the workmen, to break down or to occupy valuable space, and each printing press can be instantaneously started up at full power.

Gas and Book-Binding. ACCORDING to a writer in one of the journals specially devoted to book-making, so destructive have been the influences of gas and furnace heat on Russia leather bindings that this handsome material is now almost entirely out of vogue as a book cover. It is also noted that the introduction of gas and steam pipes, etc., is followed by the descent of myriads of roaches, which pay special attention to cloth bindings. A single roach will disfigure a book in a night and render it an unsightly object. The complaints about the effects of gas on books are not new, but this is the first time that we have seen reference made to the evil of cockroaches as a consequence of gas. Probably the supercession of gas by electricity in our large public and private libraries will go far to save rare and costly books from destruction, and we are glad to see that electricity has been adopted for the Metropolitan Museum in this city, where the many treasures in all manner of material would have suffered greatly had gas been employed.

A Novel Electric Meter. SOME time ago one of the New York daily papers, in alluding to the fact that an electric meter had been found to give a false record, promulgated the theory that the phenomenon was accountable for by the fact that the electric meter had been placed in close proximity to the notoriously mendacious gas meter, and it strongly recommended the separation of the two, as far as possible, where both gas and electricity were used in the same building. Indeed, the superiority of the electric meter over the gas meter has been so often pointed out that a device embodying a combination of the two would hardly have been deemed advisable, if at all possible; yet an ingenious inventor has embodied both in a current meter, which is described in another column, and which gives its indication by measuring the quantity of gas liberated by the passing of the current in the circuit. This curious apparatus is another instance of the flexibility and ease with which the electric current can be adapted to all purposes.

Standard Wiring Rules. ON another page Mr. C. H. Crockett supplements in an excellent article his recent communication on standard rules to be adopted for wiring buildings. With the various systems of electric lighting now in the field and actively pushing for business, it seems indeed time that buildings in the course of erection, and designed to be lit by electricity, should be so wired that any existing system may with safety and economy be installed. The experience of the past has proved that in many cases this important consideration has been entirely overlooked, and the result is that much vexation and expense has been incurred when at last the actual installation of dynamo and lamps has been undertaken. Mr. Crockett suggests rules which appear to him to cover the subject, but while they appear good in a general way, they lack that specific quality which rules that are to be universally followed should possess. The question itself is of such importance that it might well be brought to the attention of our scientific and other electrical bodies, who should thoroughly discuss the question and formulate rules as to the size of wires to be employed, but which should also determine their proper insulation. We believe that much good might be done by the formulation and standardizing of such a set of rules. Indeed it seems to us that the time has come when the demand for the reform is almost peremptory, not only from the standpoint of the architect, who has to be guided by electricians in this matter, but also in regard to insurance.

The Marking of "Poles." IN a communication which recently appeared in our columns, Mr. H. F. Watts alluded to the fact that the words "positive" and "negative" as applied to electrical apparatus frequently lead to confusion, and he held that they ought to be dropped from electrical nomenclature and replaced by more appropriate words, *i. e.*, by words which are self-explanatory, and of such a nature as to cause no confusion in the minds of persons who are not familiar with electricity. Thus he showed that the terminal from which the current passes out of the dynamo is marked +, and that by which it enters the machine is marked —; but the reverse is the case in the lamps. Thus, in order to connect a lamp with the dynamo it is necessary to connect a + with a +, and — with a —; whereas to connect two dynamos in series the + must be connected with a —, and the — with a +, respectively. Mr. Watts at that time proposed to replace the signs + and — by the letters O (out) and I (in), in order to indicate, respectively, the points at which the current enters and passes out of the apparatus. In considering this subject, M. Hospitalier, in *l'Electricien*, differs from Mr. Watts, and asserts that the signs + and — are perfectly intelligible and sufficient, as they always indicate for a given apparatus a point whose potential is greater (+), and a point whose potential is less (—). The action of different apparatus is fixed by this condition, especially in the case of accumulators in which the current enters and leaves alternately by the same pole, according to whether the accumulator is being charged or discharged, and the words "in" and "out" would thus lose their meaning. In this case the signs + and — always retain their exact meaning as they always apply to points of greater or less potential, whatever be the direction of the current. M. Hospitalier hence concludes that there is no good ground for changing the present mode of designation.

Western Union Overhead Wires. IT was hardly to be expected that Judge Wallace would allow the Western Union Company in its fight against the Board of Electrical Control for the maintenance of its overhead wire and pole lines through the streets of the city to shelter and entrench itself behind the franchises it enjoys from Congress. Judge Wallace naturally holds that supervision of electrical wires falls properly within the police jurisdiction of each State and its officers, and he pointed out, moreover, that the order to put wires underground is not an interference with the privilege to maintain telegraph wires "over and along post roads." This privilege, he points out, is not to be construed literally so as to exclude regulation by the State, regarding location, mode of construction and maintenance, as demanded by the public interest in each case. The result of this decision on the part of Judge Wallace, therefore, is to give the Board of Electrical Control full power in the premises, save so far as the wires strung along the elevated railroad structures are concerned; and there is reason to believe that the Board will exercise its amplest powers in the matter. It is a little bit unfortunate for the Western Union in its fight that its own expert, Mr. G. A. Hamilton, should so recently have publicly declared his opinion that the underground system in this city is practically feasible for telegraphs, and it is also unfortunate that its wires underground in other cities, such as Boston and Chicago, should be working with thorough success. By this time it is pretty well admitted on all hands that underground telegraph, telephone and incandescent wires, if well laid in good cables, can be made to operate successfully, and that so much has been proved ought to be accepted as a good augury for the final success of underground wires carrying high potential currents. Up to the present, as everybody knows, underground arc lighting circuits have been very much of a failure. So little can be said for the experiments that it is well not to say it. Just at the present time, however, the determined efforts which are being made in this city with lead cables through the conduits give better promise than has ever been reached before; and if the cables go on steadily increasing in insulation resistance, as they are now reported to be doing, we shall certainly be within touch of the goal. In the meantime, patience and prudence are required, as well on the part of Mayor Grant as of anybody else.

NEW BOOKS.

SPECIAL-APPARATE FUER ELEKTRISCHE BUEHNEN-BELEUCHTUNG. Allgemeine Elektricitaets Gesellschaft, Berlin. (Pamphlet.)

After putting in a large number of installations for the electric lighting of theatres, the Allgemeine Elektricitaets Gesellschaft, of Berlin, have finally adopted a standard series of special apparatus for this purpose, with the aid of the best stage managers, and the pamphlet describes these in a very interesting manner. It contains descriptions of a new stage regulator and movable resistance box, and arrangements for border lights, bunch lights, and the various switches for throwing in all these at will. The pamphlet is neatly illustrated, and the apparatus seems to be well considered in all its details.

ANCIENT AND MODERN LIGHT-HOUSES. By Major D. P. Heap, U. S. A. Boston: Ticknor & Co., 1889. Square 8 vo, 220 pp. Illus. Price, $5.

Major D. P. Heap, the author of this interesting and valuable work, is well known to electricians through his report on the Electrical Exhibition of 1881, at Paris, published in 1884. An excellent section of that report dealt with the history of the application of the electric light to lighting the coast of France, and the matter therein given is of service to-day. The present monograph, however, is an exhaustive treatise on the whole subject of light-houses, ancient and modern, and seems to us one that electricians should become familiar with, since, if we do not greatly mistake the signs of the times, it is they who will ere long be charged with the responsibility for the successful operation of not a few modern light-houses. The introduction of the electric light is causing innovations and improvements in this department of illumination, as in others, and it is highly desirable that they who will have to deal with the planning and installing of the electrical apparatus should adequately realize the conditions that have to be met.

"To select the proper sites for light-houses," says Major Heap, "to plan and erect them on difficult sites, to devise suitable optical apparatus, illuminants and lamps, to appoint proper keepers, to furnish the supplies, and to attend to all the minutiæ consequent upon a service whose stations are scattered along a coast and are frequently difficult and dangerous of access, requires a combination of qualities seldom found in an individual." He then proceeds to describe the light-house service and control of the various maritime nations; and the other parts of the work exemplify the serious nature of the difficulties that he thus enumerates. Perhaps the descriptive chapter that will most interest electricians is that on the fine light-house on the Isle of May, Scotland, where the resulting beam of light from the De Meritens alternating machine and Serrin-Berjot lamps is of 3,000,000 c. p., while with both machines the beam is about 6,000,000 c. p. Other portions, too, in which they have special concern are those on the Hell Gate light and on the Millis-Mackenzie buoy lighting in the Gedney Channel, which we illustrated recently.

This book is far from being simply scientific. Major Heap writes with a keen appreciation of the romantic and picturesque elements of light-house work, and finds space for snatches of verse and happy prose quotations. The volume is profusely illustrated throughout, not only with plans and perspectives of many a famous modern pharos, but with reproductions of rare prints of old ones.

THE VOLTAIC ACCUMULATOR. By Emile Reynier. Translated from the French by J. A. Berly. New York, E. & F. N. Spon. 5½ by 8½ inches. 202 pp. Price, $3.

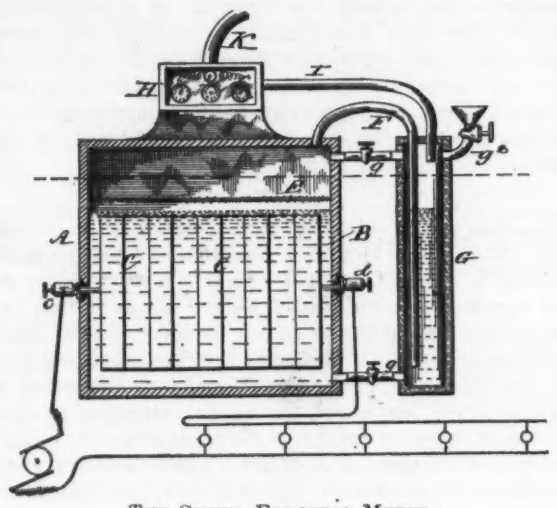
Reynier's work, which appeared in French a number of years ago, was a most excellent little treatise, and its translation into English must be welcome, as it places in the hands of the English reader, in a collective form, material which is for the most part scattered through periodical literature. The contents of the book are divided into four parts, including the principles embodied in the operation of accumulators, the construction of the accumulators themselves, their technology and their application. Beginning with the principles, the author first defines the secondary action as exhibited in the voltameter, and then describes the various forms of the latter, such as the platinum voltameter in dilute sulphuric acid, the lead voltameter, and carbon, copper and other voltameters. The author then takes up the subject of voltaic accumulators proper, and beginning with the Planté, describes the original form and a large number of others which have been developed from it. The cells in this section are divided into three classes, including those made on the original Planté type, by direct forming, and those in which the active material is applied to a plate of lead; and third, miscellaneous accumulators, in which combinations of lead-copper, lead-zinc and other materials are employed. Under these various heads we find described the Tommasi, De Kabath, Simmen, Reynier, Fitzgerald and a variety of other accumulators. The descriptions are quite full, and are generally accompanied by details of weights, capacities, sizes, etc., so that a good comparison may be made between the various forms.

Under the head of technology, the author takes up the subject of electromotive force, storing capacity, etc., of accumulators and their management, and gives the methods and capacity of the accumulator as applied to different kinds of work. The last part of the book, which treats of the various applications of the storage battery, shows the manner in which it may be applied to scientific research, telegraphy, electric lighting, locomotion and a variety of similar purposes.

The book is well illustrated, and as we have said before, contains the elements of useful information as it is written generally in a simple style; but unfortunately its value is seriously detracted from by the slovenly work of the translator. We need only give a few illustrations to show that our criticism is justified. Thus the author frequently speaks of "sulphuric acidulated water," and he speaks uniformly of "gratings" for grids, as well as of "permeable" for "active" material. We are also told that "power is homogeneous to the product of a force by a speed," whatever that may mean; and the following will hardly, we think, be considered an elegant sentence: "A portion of the elevating works and of the live powers may be recuperated for recharging accumulators en route; the dynamo acting as a charger under impulsion of the train in stiff inclines and sudden stoppages." We might multiply examples indefinitely, but those we have given will, we think, be sufficient. We hope that this otherwise useful work may be "licked" into good English which will leave no doubt in the mind of the reader, unacquainted with French, as to the meaning of the author.

Smith's Novel Electric Meter.

Electric meters have been devised in the past depending for their action on a variety of principles. Thus we have the electrolytic meter, which depends upon the deposition of metal by the current; the various forms of motor meters, in which the number of the revolutions of the motor is registered; and, again, meters depending upon the heating properties of the current, and a variety of others. The list has recently been augmented by a curious arrangement, designed by Mr. Walter F. Smith, of Philadelphia. Mr. Smith's arrangement may be called a combination of an electrolytic and a gas meter, and its



THE SMITH ELECTRIC METER.

operation will be readily understood from the accompanying illustration, which shows the meter in section.

As will be noted, the electric light circuit is connected to the binding posts *c d*, so as to place the meter in series in the circuit, and thus cause the entire current to pass through it. The binding posts are connected to two series of plates *C C*, which are immersed in a solution of caustic potash, the plates themselves being of iron, or iron nickel plated. Directly above the electrodes there is arranged a screen of iron wire gauze *E*, for the purpose of preventing the overflow of bubbles of gas which are formed on the passage of the current.

As the gas is formed on the passage of the current, it passes out through the pipe *F* into the vessel *G*, which acts as a sort of condenser and receives any froth or entrained moisture which may come from the vessel *E*. After passing out of the bottom of the spout *F*, the gas rises in the vessel *G* and is forced into the pipe *I*, which leads directly to a gas-measuring apparatus *H*. Here the quantity of gas passing through is measured and indicated on dials, exactly as on the gas meter, after which the gas is passed out to the atmosphere through the pipe *K*. As the quantity of gas generated is directly proportional to the current, and the latter to the number of lamps in circuit, it is evident that the meter *H* will indicate directly the total amount of energy passed through the circuit, which can be read off on the dial.

Enamel Insulation for Dynamos.

To the Editor of The Electrical World:

SIR: In your paper of the 6th you have a notice, taken from the London *Electrician*, of a new insulating material.

In reply to it, I will say that patent No. 393,666, issued to me Nov. 13, 1888, covers the entire principle of using vitreous material on thin metal in sheets or on thin cast drums or spools, or on armature discs, for the purpose of insulating the cores of field magnets or armatures, so that bare copper wire can be used if desired.

Parties wishing to use it can do so on the payment of reasonable royalty.

BENSON BIDWELL.

Standard Rules for Wiring Buildings.

BY C. H. CROCKETT.

Mr. A. R. Foote, in the columns of THE ELECTRICAL WORLD of a recent issue, has shown very clearly the necessity of some uniform and standard system of wiring for buildings in which it is proposed to ultimately adopt the incandescent light, but where at the time of wiring no definite idea is possible of the particular system of lighting which may be used.

Omitting the consideration of the many details of insulation, safety and other matters which have been already carefully looked after by our friends the underwriters, we find that the two most important questions which arise in trying to solve this problem are these: First, what shall be the basis upon which to determine the size of our conductors? And, second, what must be the nature or arrangement of circuits to be suitable for the various methods of lighting already in use, or which may be introduced in the future?

There is a chance for considerable difference of opinion as to what would constitute proper answers to the above questions, but for the purpose of agitating this subject in some way, I would suggest that this really difficult problem might be solved as follows:

The standard lamp, upon which all calculations shall be based, to be the 50 volt, 1 ampère, 16 candle-power lamp. The wiring to be done on the three-wire system, all three wires to be of uniform size, circuits to be arranged with reference to the possibility of using either the three-wire or ordinary multiple arc system. The fall of potential should not exceed 3 per cent. at any lamp under full load, and calculations to be made on the three-wire system converted into multiple arc. For the sake of simplicity the fall of potential ought to be equally divided between the tap or branch wires and the mains, *i. e.*, 1½ per cent. drop on the taps, and 1½ per cent. drop on the mains. Of course due attention must be paid to the fact that should the multiple system be used, the neutral wire of the three-wire system would have to carry the current of both of the other wires, and safety fuses would necessarily be proportioned with this fact in view.

It might be argued that a 3 per cent. drop would be too great for good regulation, should 50 volt lamps be supplied from a central station, but as so low a voltage would only be used with transformers, the regulation should be very good with proper distribution, from the fact that a nearly constant potential difference is maintained at the transformer terminals, the variations in pressure at this point being much less than at the junction of the service and house wires on the direct systems.

Then, again, as the tendency is towards lamps of greater efficiency, the regulation will be nearer perfection as improvements in this direction take place. In any case the cost of the necessary copper would not be excessive with a 3 per cent. loss on the conductors. For 75 or 100 volt lamps the drop would be so small as to be hardly noticeable.

Should we assume the above to be standard values, we could easily determine the size of our wires by the following simple formula:

$$A = 20 \times N \times D,$$

where A = area of cross section of wire in circular mils;

N = number of lamps in the circuit;

D = distance in feet one way, from service to cut outs for *mains;* and distance in feet one way from cut outs to lamps for *taps.*

20 = constant.

The above formula is easily remembered and applied, and the results obtained by using it are sufficiently accurate for all practical purposes.

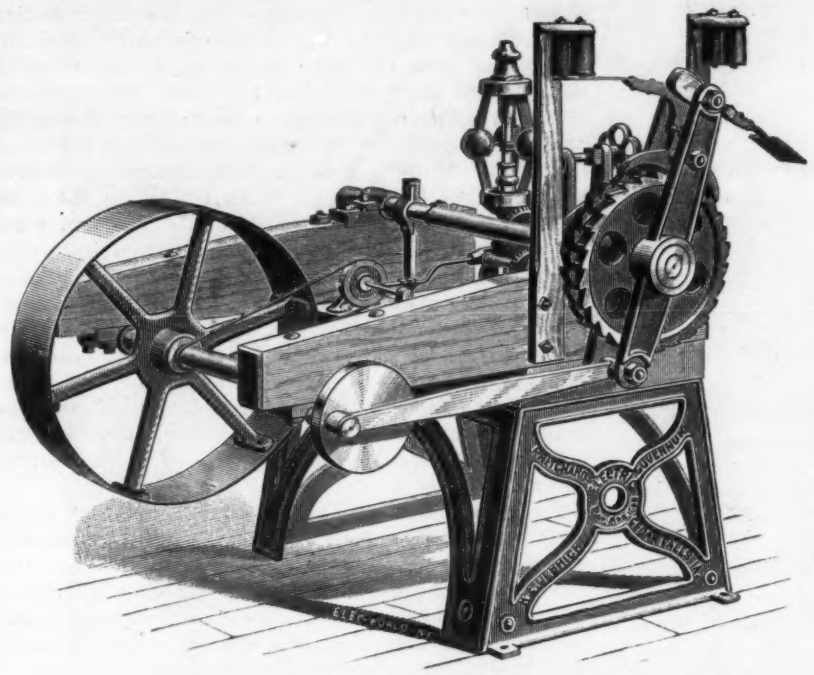
Suppose for example we had a building to be wired for 40 lamps. The distance from the service to the cut-outs is 50 feet. Then by the formula, $40 \times 50 \times 20 = 40{,}000 =$ area of cross section of wire in circular mils for the mains, which equals No. 6 B. W. G. nearly. We should, therefore, run three wires of this size for mains. Then suppose our 40 lamps to be divided into 4 three-wire circuits, and the distance from cut-outs to the lamps on one circuit is 20 feet; then the area of the tap wires for this circuit would be equal to $10 \times 20 \times 20 = 4{,}000$ c. m. No. 16 B. W. G. would be the nearest gauge number to use. The size of the wires for the other taps would be obtained in precisely the same way, *i. e.*, by multiplying the number of lamps to be supplied, by the distance in feet from the cut-outs or junction with the mains, and that product by 20; the resulting product equaling the area in circular mils of the proper wire. In practice our problems would not be in such shape as to be so easily disposed of. For the proper distribution of the wires to secure uniform candle power, with a minimum cost for copper, good judgment must be used, and careful calculations made, and questions arise which it is not in the province of this article to discuss.

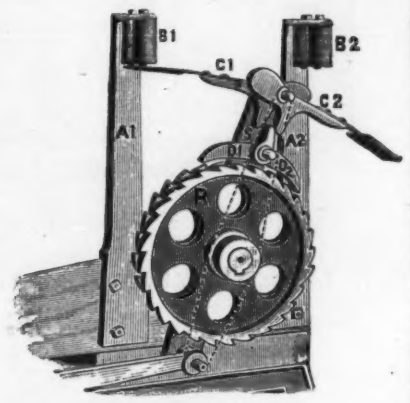
The entire subject should receive the attention which its importance demands, and it is to be hoped that a uniform system of wiring will soon be universally adopted which will benefit alike the owner, architect, contractor, and the electric light company that furnishes the current.

The Pritchard Electric Water Wheel Governor.

For some time past the water wheel driving the dynamos of the Cedar Falls Electric Light Company, of Cedar Falls, Ia., has been regulated by a simple and ingenious governor, known as the Pritchard electric water wheel governor. The operation of the apparatus has been so satisfactory that its regular manufacture has been taken up by the Cedar Falls Iron Works, and has still further been adapted to the governing of other devices.

The machine is shown in the accompanying illustrations, and will be seen to consist of two electro-magnets B^1 and B^2, placed upon standards in a stationary position. Opposite these electro-magnets are situated the armatures C^1 C^2, the weight of which overbalances that of the pawls $D^1 D^2$, and normally holds them out of engagement with the teeth of the ratchet wheel R, which is keyed to the gate stem of the water wheel, or other apparatus to be regulated.





FIGS. 1 AND 2.—THE PRITCHARD ELECTRIC WATER WHEEL GOVERNOR.

These pawls $D^1 D^2$ and armatures C^1 C^2 are carried by arms, one of which is removed for the sake of clearness in Fig. 2, but the other of which S appears, and carries the armature C^1. These two arms are continually vibrated back and forth by means of an ordinary crank and connecting rod, so that the soft iron plates which are riveted at their ends just touch the poles of their respective electro-magnets at the end of each stroke. These electro-magnets are energized by three or four gravity cells, and the terminals are brought in connection with a high-speed governor, shown in Fig. 1.

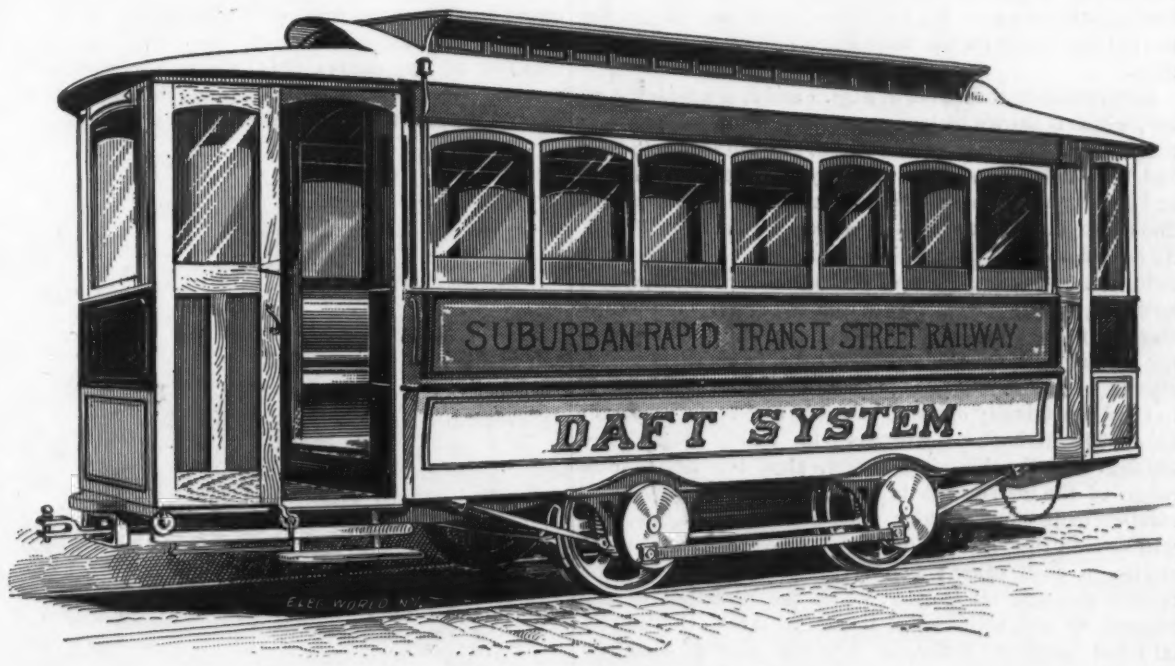
When the machine is at normal speed the magnets are not energized and the armatures swing freely back and forth; but when the speed changes the governor makes the contact, the current passes through one of the electro-magnets, and by the magnetism produced causes the respective armature to adhere to the same. This, in turn, allows the pawl controled by it to drop into engagement with the teeth of the ratchet wheel, causing the latter to turn in that direction until the variation in speed is corrected, when the electric circuit is again broken by the governor. The two electro-magnets are evidently employed to control both the increase and decrease in speed, and their action is identical, as will be easily understood.

The same principle can be readily applied to the operation of rheostats for maintaining constant current or potential on electric circuits, for which purpose the governor may be replaced by a solenoid, which makes the desired electric contacts. For such purposes the machine occupies but very small space. It will be noted that the machine is simple in construction. It has proved very efficientin its service.

A New Daft Electric Street Car.

The material accessories of ordinary human life soon crystallize into a definite shape which is molded by the condition that brought them into existence, the circumstances under which they are used, and the manner of employing them. Without going back to the period of the slave-borne litter, the elephant's howdah, pack saddles and pillions of all kinds, but commencing with the Venetian gondola and following down through the Swiss char-a-banc, the French diligence, the Irish jaunting car, the English mail coach and American omnibus; all serve to illustrate the fact. The commonplace street car is a notable instance of the general law. Until within a very brief period this useful vehicle had literally become a crystallization. The accretion of years of experience had developed something which seemed to meet every demand and emergency that could be thrust upon it, and, though the memory of it is often grievous, it must be conceded that it possessed the highest merit ascribable to a machine—viz., that of complete fitness for its work. It is easy to select some one of the many qualities that such constructions must possess, and argue, from its pre-eminence in this respect, that it is generally the best—a narrow method of regarding such questions, and far too prevalent than it should be—but it is indisputable that supreme excellence on one of these points can only be obtained to the prejudice of other needful characteristics, and may mean failure, as a whole, rather than success. The entire subject is a compromise—a mutual give-and-take between the essential points involved, all of which, while having different relative weight, are indispensable to general efficiency.

With the substitution of electrical propulsion for animal traction, conditions changed, and street cars developed to meet them. The illustration shows a type in use on the Suburban Rapid Transit Railway, of Pittsburgh, Pa., equipped and operated on the Daft system. The high schedule speed—12 miles per hour—renders advisable the inclosing of the platform for protection in severe weather. The heavy gradients—8.2 per cent.—which are surmounted with exceptional velocity, has led to the introduction of connecting rods to avail of the adhesion to rail of all four wheels; and other changes, not visible in the illustration, have also resulted from the augmentation of speed, power and carrying capacity pertaining to the new propulsive force. The car, complete, weighs in the vicinity of 7,500 pounds, has a maximum development of 20 h. p., and seats 20 passengers. The signal bells are electrically operated, and push-buttons behind each seat give easy communication with the driver. Six incandescent lamps light the interior of the car, and large lamps on the platforms, backed by reflectors, illuminate them and also perform the function of head-lights for the car. The road is two miles long.



A NEW DAFT ELECTRIC CAR.

It is superfluous to call attention to the vast stride here made beyond the primitive horse car—well enough for its day and generation, but now relegated to companionship with the old mail-coach of the first quarter of this century.

Should a similar development in the same period await the electro-motor car, the outcome could hardly be foreshadowed in this early phase of its existence.

German Central Electric Lighting Stations.

The German correspondent of the London *Electrician* gives the following list of central stations in Germany:

TOWN.	System.	Output in horse power.	Distribution.
Barmen	Three-wire system (Accumulators)	600	Underground.
BERLIN: (a) Markgrafen-strasse (b) Mauerstrasse	Two-wire system	3,900 together.	Underground.
(c) Spandauer-strasse*	Three-wire system	2,000	Underground.
(d) Dorotheen-strasse*	Three-wire system	2,000	Underground.
Braunschweig*			
Bremen*	Three-wire system	600	
Breslau*		500	Underground.
Cologne*			
Darmstadt	Three-wire system (Accumulators)	450	Underground.
Dresden*		500	
Eberstadt*		100	
Elberfeld	Three-wire system	325	
Ems	200 volts (Multiple series)	100	Overhead.
Frankfort-on-Main*		1,000	
Görlitz		450	
Halle-on-Saale*		550	
Hamburg	Two-wire system	1,200	Underground.
Königsberg*		300	
Lübeck	Two-wire system	300	Underground.
Magdeburg*		500	
Mühlhausen	Three-wire system	300	Underground.
Olmütz*			
Strasburg*		400	

Those marked * are in progress.

From this list it follows that in Germany there exists no central station at all that uses alternating currents; that, generally speaking, the mains and feeders are laid underground, and that for all larger stations the three-wire system is brought into use. Of the 16,000 h. p. employed in the German Empire for electric lighting by central stations, exactly one-half is used in Berlin.

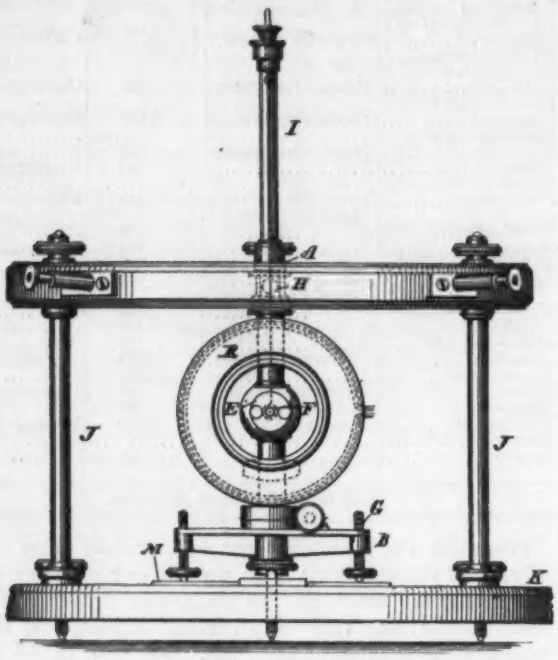
The Liquefaction of Gases by Electricity.

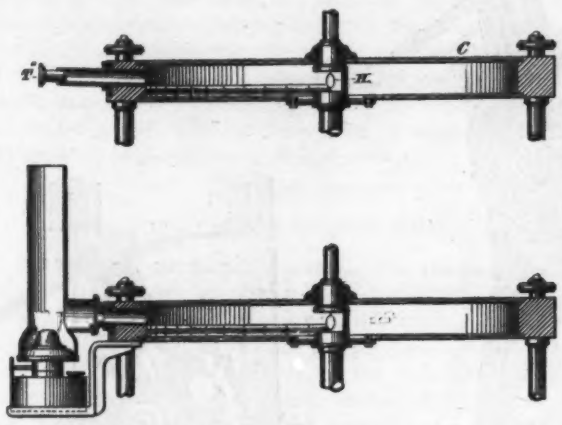
An electrolytic method of liquefying gases has been described by H. N. Warren in the *Chemical News*. Strong hydrochloric acid is introduced into a combustion tube, bent at right angles, so as to cover two small platinum plates fused into the closed end of the tube; a plug of asbestos, saturated with concentrated sulphuric acid, is placed at the bend; the open and shorter arm is then fused up and immersed in a freezing mixture. On the passage of a current through the plates gas is evolved and liquefies at the other end; but on removing the tube from the freezing mixture and discontinuing the current the liquefied hydrogen chloride is reabsorbed by the water. The experiment may then be repeated. Other compound gases behave in a similar manner. When acidified water is decomposed in this apparatus, and a platinum plate covered with platinum-black has been fused in the short end, explosions occur there at intervals, and small quantities of water form, containing hydrogen peroxide, and having an ozonized odor. With chromic acid and water the blue oxide of chromium is obtained. The method has also been applied to the liquefaction of oxygen and hydrogen, and the latter is said to have been "decidedly liquefied."

Niagara Impatient of any Harness.—Niagara Falls, according to a local authority, is laughing at Colonel Hamilton, of Topeka, and his water-wheel scheme. "I asked him," said a resident, "how he was going to operate his machinery in winter? Nobody goes into the Cave of the Winds then, and in ordinary winters that whole part of the Falls is a solid mass of ice till May, and when the ice goes out it takes with it every bit of the timber, stairs and the like that has been put in there the year before. The idea of putting machinery there is the height of foolishness.—*Buffalo Express.*

The New Weston Tangent Galvanometer.

For some time past Mr. Edward Weston has been at work on the construction of a series of standard instruments, and, as one of these, our readers will recall the Weston voltmeter, illustrated by us a short time since. Another instrument to which Mr. West has devoted considerable attention is a tangent galvanometer, in which his principal object has been to provide an instrument with a suitable scale for showing the deflections, the scale being so arranged that a very wide range of measurements can be had, and at the same time combining a scale and galvanometer in one instrument of practical dimensions. Our illustrations, Figs. 1 and 2, show the instrument complete in plan and elevation. It will be noticed that the galvanometer itself consists of the usual deflection coils, and the suspension tube *I*, in which hangs the fibre which carries the mirror *H*, to which is rigidly attached a needle which swings in the centre of the coils at *F*. The needle is inclosed in a cylindrical block *E*, made of copper, so as to dampen or check its oscillations, by which means the instrument is made very dead beat.





FIGS. 1, 3, AND 4.—WESTON'S NEW TANGENT GALVANOMETER.

The construction and relation of the parts of the standard *A* are such that a line joining the centres of the coils intersects the longitudinal axis at right angles thereto, and the magnet *F* is so arranged that its centre coincides with this point of intersection.

The galvanometer itself rests upon a base *K*, from the centre of which radiate three grooves *M*, Fig. 2, at an angle of 120 degrees to each other. Thus when the galvanometer is placed upon the base its three leveling screws enter the grooves; hence the mere act of placing the galvanometer on the base *centres* it there at the same time.

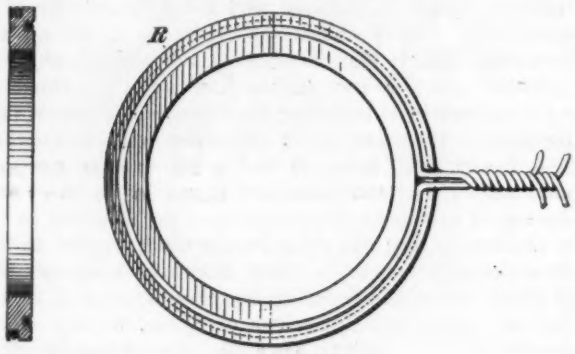
Mounted upon standards *J*, Figs. 1 and 2, is a scale chamber, which is shown in section in Figs. 3 and 4. Through this scale chamber, it will be noted, two telescopes pass, *T* and *T'*, which are sighted directly towards the centre, and from which the deflections of the needle can be read. The arrangment of the scale is shown in detail in Fig. 5. As is well known, the deflection angle read by a mirror is twice the actual angle passed through. Mr. Weston has, however, so arranged the scale that the angle read by the observer is the true one, and he accomplishes this by making the angular divisions of the scale twice the true divisions. Thus it will be noted that from the telescope *T'* to the diametrically opposite point *X* the scale embraces only 90 divisions, whereas in reality there are 180 degrees. By this construction, also, the useful scale range of the instrument is largely increased, and with smaller deflections greater accuracy is obtainable. It will be seen that the two telescopes are arranged at right angles to each other; consequently, by observing the mirror through telescope *T*, when the direction of the current in the coils is such as to move the needle into the position indicated by the dotted lines *H'* and *H''*, its angular deviation of 90 degrees can be measured upon an arc of 180 degrees from the zero point at the telescope *T'* to the point *X*. In a like manner when the current is in the opposite direction, by observing the mirror through the telescope *T'* its angular deviation over the corresponding scale distance can be read from the zero point at the telescope *T* to the point *X*. The arrangement of the two telescopes also affords a ready means of proving the adjustment of the needle and of placing the coils in the true magnetic meridian.

Another interesting feature in connection with the galvanometer is the method of winding employed for the coil. As shown in Figs. 6 and 7, a groove or channel is made in the periphery of the ring *R*, to receive one conductor, and a second groove in the face or side of the ring receives the other conductor; but these are so arranged that when the ring is in place the cone passing through the centre of both wires will have its apex at the centre of the magnetized needle. The conductors leading from the coils are twisted together, and also carried outward in a line radial to the coil centre and in a horizontal plane of vibration of the needle, as shown in Fig. 7, so as to prevent any extraneous inductive effect upon the needle.

The Rotation of the Plane of Polarization of Light by the Discharge of a Leyden Jar.

At a meeting of the London Physical Society held on March 9 Dr. Oliver J. Lodge read a paper on the above subject.

The author pointed out that electrical effects depending on the total amount of a current and not upon its duration, such as induction currents, magnetization, and rotation of the plane of polarization, can be well produced by means of the Leyden jar discharge. When a beam of polarized light is sent through a piece of heavy glass or a tube containing bisulphide of carbon, and the analyzer is so adjusted as to give the maximum extinction, a sudden re-appearance of light is observed when a Leyden battery is discharged through a coil surrounding the glass or tube.

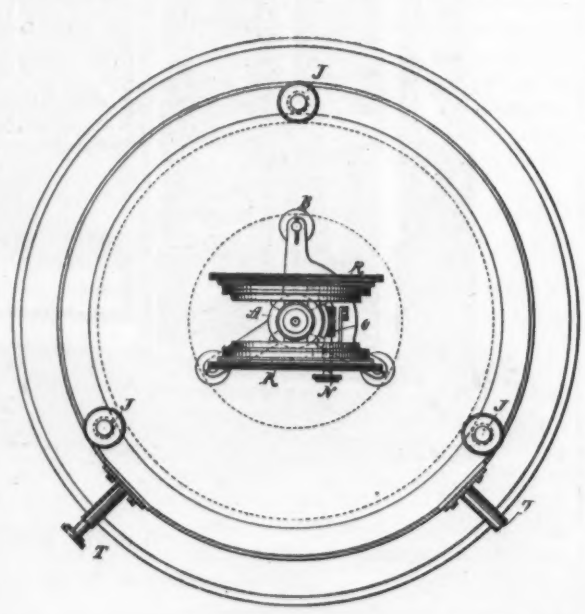


FIGS. 6 AND 7.

The oscillatory nature of the discharge, and the consequent oscillatory restoration of light in the dark field, is conclusively demonstrated by the fact that a small rotation of the analyzer in either direction from the position of maximum extinction has the same effect, and also by the fact that the sensitive tint of a biquartz is unaffected by the discharge. The effect seems to be instantaneous, which conclusion is at variance with that deduced by Villari (*Rendiconto* del Instituto Lombardi, Ser. 2, Vol. 3, translated in Poggendorff's *Annalen*, Vol. 149), from observations on a drum of heavy glass rapidly whirled between the poles of a magnet. Villari found that the rotation of the plane of polarization diminished as the speed increased, and almost entirely disappeared when a speed of about 180 revolutions a second was attained, from which he concluded that a time between $\frac{1}{500}$ and $\frac{1}{100}$ of a second was required to produce the effect.

In 1882 Messrs. Bichat and Blondlot had made a series of experiments (*Comptes Rendus*, Vol. 94), from which they concluded that if time were required to produce the effect it could not exceed $\frac{1}{50000}$ of a second. In order to determine whether any perceptible time was required for the effect, the two French physicists allowed the light traversing the tube to illuminate a slit, while a second slit immediately above the first was illuminated by the spark of the discharge causing the rotation. The light passing through both slits was spread out into discontinuous bands by means of a revolving mirror, and the serrations in the two bands were found to agree exactly as far as could be observed, showing that no perceptible time was required for the production of the effect. Professor Lodge found from his own experiments that the sulphide of carbon shows the effect when the rate of alternation is as high as 70,000 in a second. The oscillatory character of the effect was then exhibited to the society by allowing the polarized beam which had traversed the sulphide of carbon to fall upon a rotating mirror after adjusting the analyzer to give the maximum extinction possible. A faint band of light was thus obtained, which became brighter at every discharge round the tube. When the analyzer was slightly rotated in either direction every alternate band became fainter, while the remaining ones became brighter, which distinctly demonstrated the oscillatory character of the light. The author then gave the theory of the effects observed, and showed that to get large effects a large battery charged to a high potential should be employed; also that the addition of self induction is indifferent, the reason being that, while it diminishes the effect of each oscillation, it prolongs its duration. Increased resistance diminishes, of course, the effect.

Professor Lodge then exhibited an experiment analogous to some of Dr. Hertz's, illustrating electric resonance. The sparks from a Holtz machine were made to pass between two brass balls a small distance apart. In front of the air space traversed by the sparks was placed a resonator, which had been turned to electric unison with the circuit of the Holtz machine. This resonator consisted of a pair of condenser plates placed at a short distance apart, and nearly touching at one edge, so as to allow of a spark passing, the plates being joined by means of a gutta-percha covered wire. Sparks were then seen to pass between the condenser plates when the machine was in action, and it was shown that the insertion of additional self induction in the resonator circuit caused a cessation of the sparks by throwing it out of unison with the exciting circuit.



FIGS. 2 AND 5.—WESTON'S NEW TANGENT GALVANOMETER.

Testing Chain Cables by Electric Light.

An interesting experiment with the electric light has been successfully carried out recently by the River Wear Commissioners. Hitherto the testing and examining of chain cables had always been done in daylight, no artificial light being considered sufficient to detect the fractures in the cables after testing. That being the case, the management of the River Wear Commission directed that an artificial light of some kind should be experimented upon, with the result that the electric light, applied by means of portable lamps attached to the caps of the examiners, has been adopted, and enables the Commissioners to almost double their output in connection with their testing department. Seven 800 candle-power "Sunbeam" lamps, run off one of Parsons' turbo-electric generators, were originally installed; but the result of the fixed lights was not altogether satisfactory. Under these circumstance the localising of the light was considered the next best thing to do, and in order to accomplish this a 16 candle-power lamp was attached to the caps of the workmen known as the examiners, with a flexible cable connected with the main cable above, which allows the men to work within a certain radius. This device, which has proved a great success, was introduced by Mr. Hartness, the manager of the test works.

Operating the Bridgeport, Conn., Drawbridge by Electric Motor.

One of the latest appliances of the electric motor which has excited much interest, not only from its novelty, but also the excellence of its operation, is that of the turning of drawbridges. This is a matter to which a good deal of attention has been given by bridge builders and electrical men, but it is not until recently that the motor for this purpose has supplanted steam and the slow, laborious method of the long lever worked by two or three men.

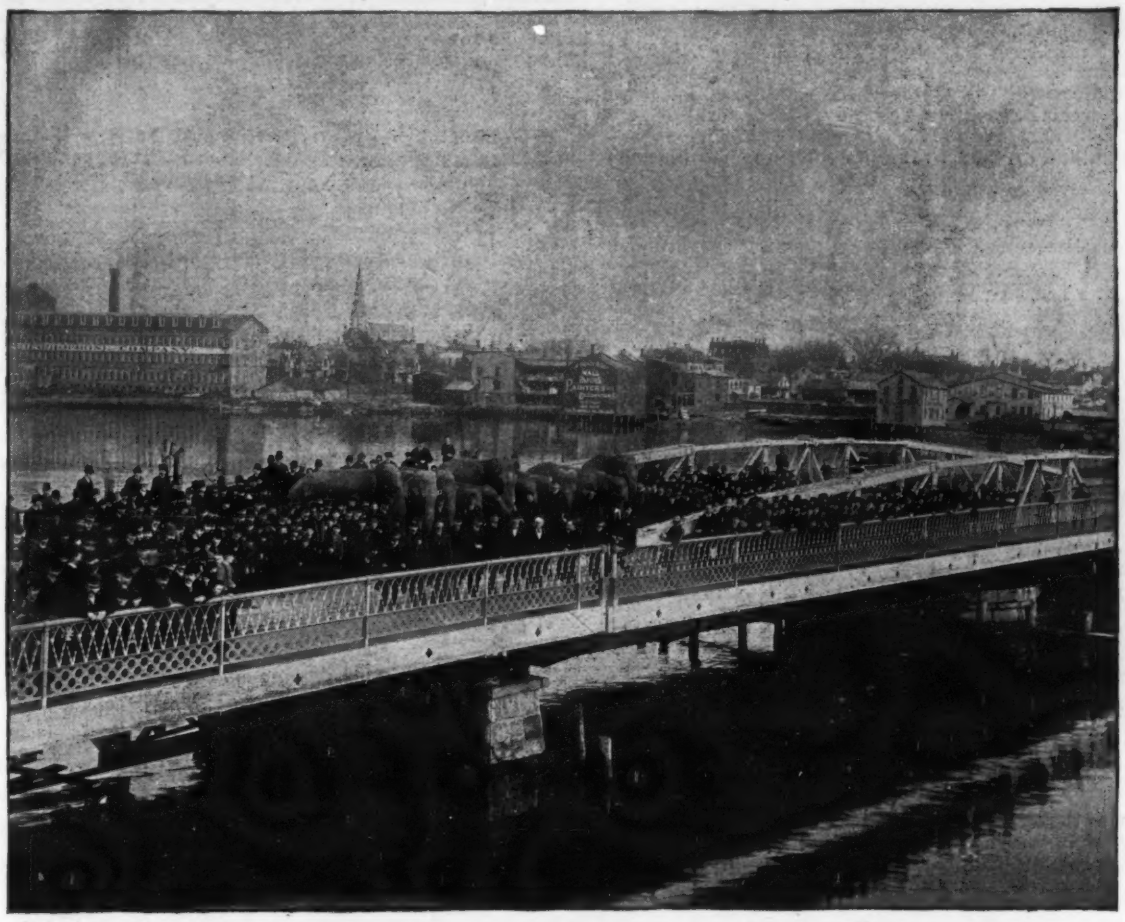


FIG. 1.—BRIDGEPORT, CONN., DRAWBRIDGE OPERATED BY ELECTRICITY.

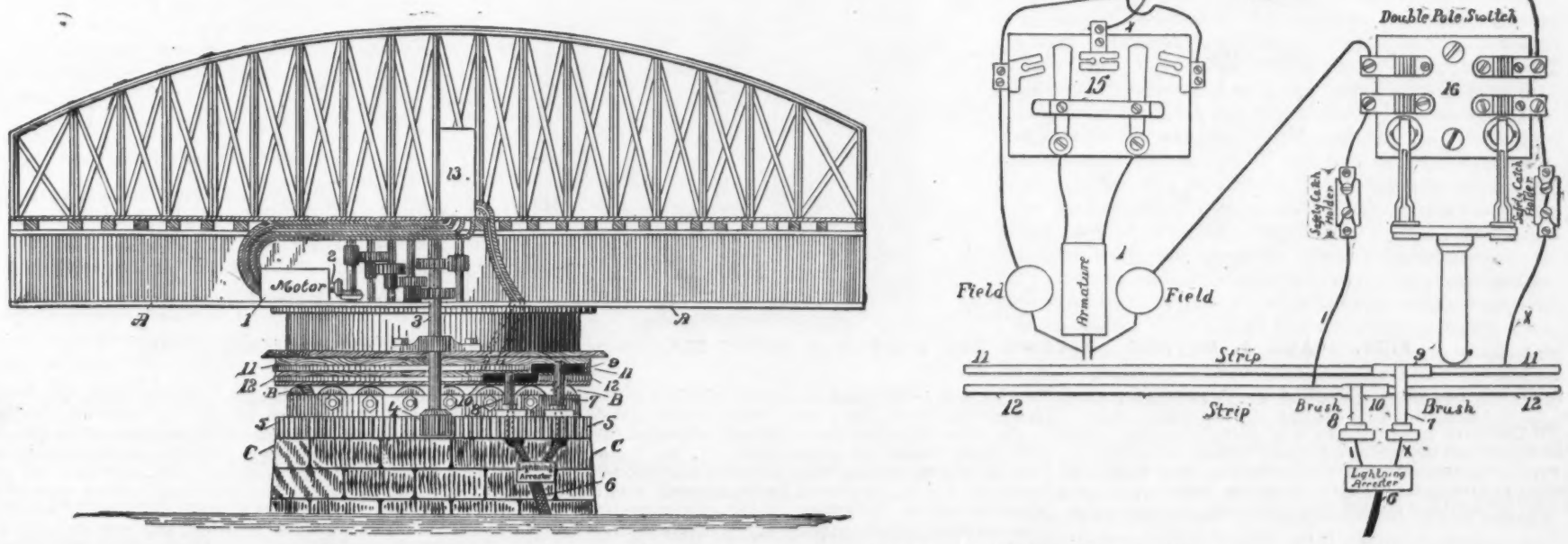
One installation, the details of which are shown in the accompanying cuts, has recently been made at Bridgeport, Conn., by the New England Electric Supply Company. The drawbridge, which is 180 feet long, 60 feet wide and weighs 320 tons, was formerly operated by three men, but this method was found to be open to serious objections, and attended by considerable expense, as it necessitated the constant attendance of the men, and under the most favorable circumstances it took six minutes to open and close the draw, which caused a jam on both sides and seriously interfered with the traffic.

The problem of applying electricity as a motive power has been successfully worked out to the satisfaction of the city officials and the bridge builders. The draw can be opened and closed in two minutes, and the expense is limited to the hiring of one man, and the monthly charge of the local electric light company, by which a considerable saving is effected.

The details of the construction are as follows: The current is conducted to the motor through two submarine cables, the core being equal to No. 4 B. and S. copper wire, which are protected from lightning by two Thomson-Houston lightning arresters. The shore ends are connected to the incandescent lighting circuit of the Bridgeport Electric Light Company by a double pole switch, so that the current may be shut off at the pleasure of the draw tender. The other ends are connected to vertical station-ary posts, which are carefully insulated from the structure, and which carry on their upper ends a pair of brushes which are in contact with two insulated copper bands attached to the circular support on the draw and moving with it.

A rheostat is used to regulate the speed of the motor and a reversing switch to change the direction of rotation of the armature. The armature, rheostat and fields are connected in series. The double switch, fuses, reversing switch and rheostat are inclosed in a water-tight box in the framework of the bridge, and are easily accessible from the road-bed. The bridge tender has everything under complete control and can easily regulate the speed and direction of rotation of the drawbridge. The motive power is furnished by a 7½ h. p. Thomson-Houston motor, securely fastened to the draw by iron braces. On the end of the motor shaft is a pinion which drives a train of gears, the last of which turns the shaft formerly operated by the men.

This installation is complete in every detail. Its operation is excellent and it reflects much credit upon the Thomson-Houston apparatus. The New England Electric Supply Company has received much praise from mechanical and electrical engineers for the good work it has thus done. It has applied for patents on the devices used, and is in communication with several cities which contemplate installations of the same nature.



FIGS. 2 AND 3.—DETAILS OF ELECTRIC DRAWBRIDGE AT BRIDGEPORT, CONN.

A Question of Absolute and Relative Standard.

To the Editor of The Electrical World.

SIR: 1. On page 124 of "Hand-book of Electric Telegraphy," by Lockwood, first paragraph, in reply to query 115 I find the following statement:

"The electromotive force of a voltaic battery *may be determined* by several methods, *but as no absolute standard of electromotive force is known*, we cannot determine the force of any particular battery in standard units (volts)."

The first and last parts of this paragraph appear to me to conflict.

How is it possible to determine the E. M. F. of a battery if there is no absolute unit? 2. What is the unit used by makers of the so-called voltmeters, and how do they get it? X.

ANSWER: We have submitted query 1 to Mr. T. D. Lockwood and his answer is given below:

Your correspondent takes exception to or finds a contradiction in terms, in reply to query 115 in my book on "Telegraphy," etc. which states: "The electromotive force of any battery may be determined by several methods, but as no absolute standard of electromotive force is known, we cannot determine the force of any particular battery in standard units, (volts)." He then goes on to ask, "How is it possible to determine the E. M. F. of a battery if there is no absolute unit?"

I may at once acknowledge that there is some ambiguity in the statement, which, however, may be in a great measure removed if your correspondent will simply read the continuation of the paragraph which says, "but can only compare the relative forces of two or more batteries."

It will be further elucidated by inserting in the passage which he quotes between the words "cannot" and "determine," the qualifying word "directly." Referring then to his question, he will note that he assumes premises which are not warranted; it is nowhere stated that "there is no absolute unit," but that "there is no absolute standard." That is, since at the time of writing, there was no source of electricity standardized to give an E. M. F. of exactly one volt, the best we could do was to compare the source having the unknown E. M. F. with one whose E. M. F. was known, and to figure out the result in some one of the ways thereafter described. Since that time direct reading voltmeters have been devised, but so far as I know there is still no absolute standard.

Since I am writing upon this subject, I may as well call the attention of "X" to a slip found in reply to query 93, lest at some future time he, or others, may require an explanation, although the mis-statement is so palpable that perhaps no explanation should be necessary.

The following statement is there made: "Thus, if speaking of a given circuit, we say that it has a current of fifty ampères, and we know that the resistance of the circuit is fifty ohms, we know at once that the E. M. F. must be fifty volts." As a matter of fact we don't know anything of the kind. We get at the E. M. F. in such a case by multiplying the resistance in ohms by the current in ampères, and fifty multiplied by fifty being 2,500, it follows that the E. M. F. is 2,500 volts.

(2) Commercial voltmeters are usually calibrated by means of standard cells such as the Clark, in connection with known standard resistances. The Clark cell has an E. M. F. of 1.435 volt, and by the method of comparison the indications of the instrument may be calibrated over wide ranges.—EDS. E. W.

Measuring Self-Induction by Means of Ayrton & Perry's Secohmmeter.

During the early part of last year Profs. Ayrton & Perry brought out an ingenious instrument for the measurement of self induction, which they designated by the name of secohmmeter, and which we described at the time.* The instrument is shown in perspective in Fig. 1, the cover being removed so as to expose the interior parts.

The instrument, it will be remembered, consists of two rotary commutators, each with four stationary brushes. The commutators are on the same spindle, one at the front, and the other at the back of the secohmmeter, but for convenience they are shown in the accompanying diagrams, Figs. 2, 3 and 4, as if they were in the same horizontal plane; in reality, however, the brushes, b_1, b_2, b_3, b_4, are at the top of the instrument. One commutator, *G C*, is used for periodically reversing the galvanometer connections, and the other, *B C*, for reversing the battery connections. An adjustment is provided for enabling the relative positions of the two commutators to be varied, so that both reversals can be made to occur simultaneously, or one a little before or after the other, or one reversal midway between two successive reversals of the other.

The commutators can be driven at one or other of two speeds relatively to that of the driving handle. With one arrangement there are rather more than eight reversals of both the galvanometer and of the battery for one revolution of the handle, and with the other 24 reversals of each for one revolution of the handle. The secohmmeter can be conveniently driven by hand so as to obtain a steady speed of 300 to 6,000 reversals per minute of both the galvanometer and the battery.

The following directions for the use of the instrument, for which we are indebted to Messrs. J. W. Queen & Co., of Philadelphia, the agents of Profs. Ayrton & Perry, will, we are sure, prove of interest to our readers:

To shift from one speed ratio to the other, press down the end of the locking lever at the left of the secohmmeter, and slightly push in or pull out the handle, turning it slightly to assist the toothed wheels engaging properly; when engaged, let go the end of the locking lever.

1. *To Compare two Coefficients of Self Induction.*—Join up the apparatus as in Fig. 2,† then, if the resistances, r_1, and r_2, of the non-inductive branches of the bridge be adjusted to give balance with a steady current, balance will also be obtained on rotating the secohmmeter, when

$$\frac{L_1}{L_2} = \frac{r_1}{r},$$

L_1 L_2, being the coefficients of self induction of the inductive branches. The speed at which the secohmmeter is driven need not be known, but the greater the speed the more sensitive the test; the rate of reversal must not, however, be too great for the currents to reach their steady values between two consecutive reversals.

2. *To Compare two Capacities.*—Join up the apparatus as in Fig. 3, then balance will be obtained on rotating the secohmmeter, when

$$\frac{F_1}{F_2} = \frac{r_2}{r_1},$$

F_1 and F_2 being the capacities of the condensers, and r_1 and r_2 the resistances of the non-inductive branches of the bridge. As before, increasing the speed at which the secohmmeter is driven, merely increases the sensibility of the test without affecting the ratio connecting the capacities with the resistances.

3. In similar ways two coefficients of mutual induction may be compared with one another, or a coefficient of mutual induction with a coefficient of self induction, or either of these coefficients with the capacity of a condenser shunted by a non-inductive resistance. See various papers that have already appeared on the theory of the secohmmeter.

4. *To Measure a Coefficient of Self-Induction Absolutely in Secohms* (*a*) *Comparative Deflection Method.*—Attach a speed indicator to the commutator spindle, which is prolonged for this purpose, and join up the apparatus as in Fig. 4, *L* being the co-efficient of self-induction to be measured, and r_1, r_2, r_3, values of the three non-inductive resistances that give balance with a steady current. Rotate the secohmmeter handle at some convenient speed, causing the commutator spindle to make n revolutions per second, and observe the steady deflection, d_1, of the galvanometer. Next stop the secohmmeter and increase or diminish one of the resistances, r_1, for example, by a small amount ρ ohms, obtaining a steady deflection, d_2, of the galvanometer with the battery previously used; then

$$L = \frac{d_1}{d_2} \cdot \frac{r_3}{r_2} \cdot \frac{\rho}{8n} \text{ secohms, approximately.}$$

For this test the relative positions of the two commutators is unimportant. They may be as in Figs. 2 and 3, in which case the reversal of the galvanometer occurs midway between two consecutive reversals of the battery; or they may be as in Fig. 4, in which case the reversal of the galvanometer just precedes the reversal of the battery. The greater the value of n, the greater will be the deflection d_1, and the more accurately can it be read; but the speed must not be too great to prevent the currents reaching their steady values between two consecutive reversals of the battery. Whether this condition be fulfilled or not can be best ascertained by seeing whether the same value is obtained for *L*, for a speed considerably smaller than n.

(*b.*) *More Sensitive Zero Method.*—Instead of obtaining two deflections, the resistances, r_1, r_2, r_3, are first adjusted to give balance with a steady current, and then one of them, say r_1, is altered by an amount σ ohms, so that there is still no deflection of the galvanometer when the commutator spindle makes, say, n revolutions per second; then

$$L = \frac{r_3}{r_2}\,\sigma\,\frac{k}{n} \text{ secohms, approximately,}$$

where k is a constant depending on the relative position of the commutators. The value of the constant k, is most accurately ascertained once for all, for a given relative position of the commutators, by experimentally determining the value $\frac{r_3}{r_2}\,\sigma$ of that produces balance for a known coefficient of self-induction, when the commutator spindle is driven at some known number of revolutions per second.

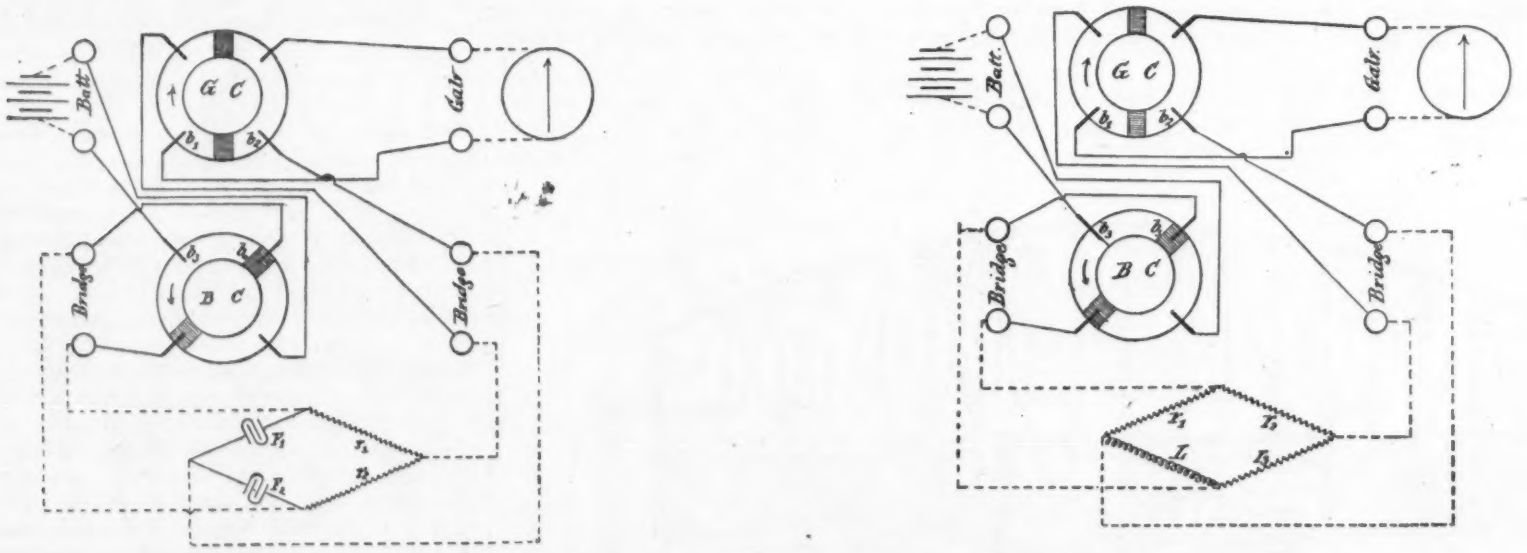
For this test (*b*) it is necessary that the commutators be so placed relatively to one another, that the galvanometer is not reversed exactly midway between two consecutive reversals of the battery, since with this latter adjustment no variation in the resistance of any of the arms of the bridge can counterbalance the effect of the self induction on rotating the secohmmeter handle; in fact, the more nearly the commutators are placed in the midway adjustment, the smaller will be the value of k, and, therefore, the larger the value of $\frac{r_3}{r_2}\,\sigma$, to produce balance for given values of L and n.

5. *To Measure the Resistance of a Polarizable Electrolyte.*—Replace the coil having self induction in Fig. 4 by the polarizable electrolyte; adjust the commutators so that the galvanometer is reversed just before the battery, and, using the higher speed ratio for the gearing, rotate the secohmmeter at the highest convenient speed. Then, if x be the true resistance of the electrolyte,

$$x = \frac{r_3}{r_2}\,r_1.$$

We may add that Profs. Ayrton and Perry will shortly bring out a standard secohm. The advantages of such a standard are evident, as it reduces the manipulations with the secohmmeter to a very few and simple ones and dispenses with the use of a speed counter for absolute determinations. In fact the standard secohm will be of such a character that it may be used much in the same way as a standard resistance is used in the Wheatstone bridge.

FIGS. 1 AND 2.—METHOD OF USING THE AYRTON & PERRY SECOHMMETER FOR MEASURING SELF-INDUCTION.



FIGS. 3 AND 4. METHOD F USING THE AYRTON & PERRY SECOHMMETER FOR MEASURING SELF-INDUCTION.

*See THE ELECTRICAL WORLD, June 16, 1888.

† The continuous lines represent the permanent connections in the secohmmeter itself, the dotted lines, connections temporarily made outside the instrument.

Relative Amounts of Voltaic Energy of Dissolved Chemical Compounds.*

BY G. GORE, LL. D., F. R. S.

In this investigation the author has measured by the "voltaic-balance" method the amounts of relative voltaic energy or of chemical affinity for zinc, of nearly 250 aqueous solutions of chemical compounds, including those of elements with elements, elements with monobasic, bibasic and tribasic acids, of all these classes with each other, elements with monobasic, bibasic, tribasic and tetrabasic salts, monobasic, bibasic and tribasic acids with all these classes of salts, and all these classes of salts with each other in large variety; and he offers the results as additional evidence in support of the conclusion that "*every electrolytic substance or mixture when dissolved in water unites chemically in definite proportions by weight with every other such dissolved body*, provided no separation of substance occurs;" and that "there may probably be discovered thousands of such compounds which only exist while in aqueous solution, and are decomposed on evaporating or crystallizing their solutions" (Roy. Soc. *Proc.*, Vol. XLIV., p. 267). The results are given in the form of a volta-tension series of electrolytes.

*Abstract of a paper read before the Royal Society, March, 1889.

Medical Electricity.

The Société Médicale de Bruxelles has offered a prize of 2.000 fr. for the three best papers upon the following subjects: 1st. The measurement of the electric currents in the animal tissues. 2d. The measurement in ohms of the resistance offered by liquids and tissues in living organisms to feeble currents. 3d. A review up to date of the works on, and researches into, the theory of electric endosmose and its application to the phenomena of secretion in living organisms. The papers must be sent to Dr. Stienon, Rue Horn, Brussels, before Jan. 1, 1890.

New Apparatus of the Bernstein Electric Company.

The rapid development of the system of using incandescent lamps in series has resulted in the production of various devices to meet the unusual conditions arising in this system of distribution, and the Bernstein Electric Company, of Boston, one of the pioneers in this field, have devoted special attention to the details of apparatus, upon which much of the success obtained depends. Some months ago we published a detailed description of the Bernstein socket, lamp and automatic cut-out, and we are informed that the lamps and fittings have since been placed in very large numbers in all sections of the country. The socket has for its two distinctive features, the combination of the cut-out and key in a single piece and the use of insulating material for all outside parts.

The high resistance offered by any considerable number of incandescent lamps in series has necessitated the construction of switches especially designed to destroy the arc which is formed between the switch terminals, and the accompanying engravings, Figs. 1 and 2, show the two styles of switch which the Bernstein Company have just brought out. These switches are so constructed that the space between the main terminals lies in the magnetic field of a small electro-magnet, which is in the direct circuit, and the lines of force of which at once destroy the arc formed between the terminals when the switch is opened.

The action is said to be instantaneous. Of the two types shown in the engravings, that seen in Fig. 1, is a simple shunt switch for inside use, and the other, Fig. 2, an absolute "cut-off" switch for use on the outside of buildings to entirely disconnect the main circuit from the branch.

The Bernstein Company has also perfected and is now introducing an improved street fixture for incandescent lamps. The fixture is strong and compact, and shows the

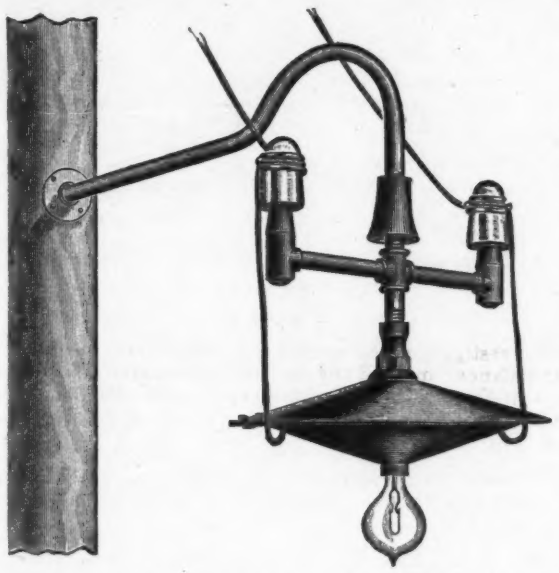


FIG 3.—NEW BERNSTEIN SERIES INCANDESCENT LIGHTING APPARATUS.

great attention to mechanical details which characterizes all the work of this company. The engravings, Figs. 3 and 4, show the fixture as it appears in use, and also with the lamp removed and the socket exposed.

We may add that the Bernstein Electric Company has recently moved into a large factory which has been thoroughly equipped with the most approved apparatus, and where it will be enabled to produce lamps and fittings in large quantities.

The Neyreneuf Electric Valve.

An arrangement of electrodes is described by M. Neyreneuf, in the *Journal de Physique*, which the discoverer calls an electric valve, as the current can be passed one way, but not in the other. M. Neyreneuf had been experimenting in electrolysis with aluminium electrodes. With a voltameter constructed with two aluminium electrodes, with dilute acid as electrolyte, and with an alternating current, he found that pure hydrogen was evolved at both electrodes, itself a curious enough result. On constituting an arrangement with one electrode of aluminium and one of mercury, with distilled water as electrolyte, the current was found to pass in one direction only.

Telephonic Communication in Paris.

The Municipal Council discussed at a recent meeting various proposals for improving telephone communication in Paris. The concession of the present company lapses on Sept. 8, and whether it is renewed or not the rates will be lowered and better communication secured. At present the subscription in Paris is about $120 a year. The complaints about the service in Paris have at length had some effect, the company having spent over $40,000 recently on improvements, on the chance of obtaining the renewal of its concession. Among the most ingenious proposals is that of M. Léon Donnat, a municipal councilor and leading economist, who would give the lease of the telephone system to the subscribers themselves, incorporated as a co-operative society. The rate would be reduced to $80 a year at the utmost, and in addition to this subscribers would benefit as part proprietors, while the city would probably gain by the increased exchanges.

The Superiority of Hemp Covered Cables for Deep Sea Work.

To the Editor of the Electrical World:

SIR: The letter of Judge R. L. Weatherbe and your comments thereon, published in THE ELECTRICAL WORLD on

FIG. 1.—NEW BERNSTEIN SERIES INCANDESCENT LIGHTING APPARATUS.

26th of January, appear to have raised the ire of a writer in the London *Electrical Review*.

The sweeping condemnation of certain forms of cables, more especially the hempen cable, they so much dread, and which they know is fast coming to the front, is so intense, and the feeling displayed so bitter, that it is apparent a tender point has been touched.

The statement that *portions* of the 1851 Channel cable having "been lately recovered with the iron wires so slightly corroded as practically to have lost little of their original strength," is no proof that the cable generally has not suffered by oxidization. We know that frequent repairs have been made on it from time to time.

The case of the Punta-Rassa cable mentioned by the writer as being as good as when laid, is no proof that iron does not corrode. As a matter of fact, we have seen and handled the broken ends of this cable, and can therefore state that *in the position of the "recent repair"* quoted, *the iron wires were showing signs of deterioration.* The citation of a cable laid on favorable bottom, such, for example, as the continuation of the Florida Swamps, is valueless as an argument,

It is equally absurd to bring in, as an argument against a hempen cable, constructed specially for deep sea purposes, the abortive attempt to connect the Scilly Islands with the Land's End by means of a "clothes-line," for the hempen cord alluded to was more suitable for such a purpose than for a submarine telegraph cable. None but the most inexperienced would ever attempt such an operation, and they who continually quote this feeble effort at submarine telegraphy appear to be no better informed than those who formulated such a wild scheme. The

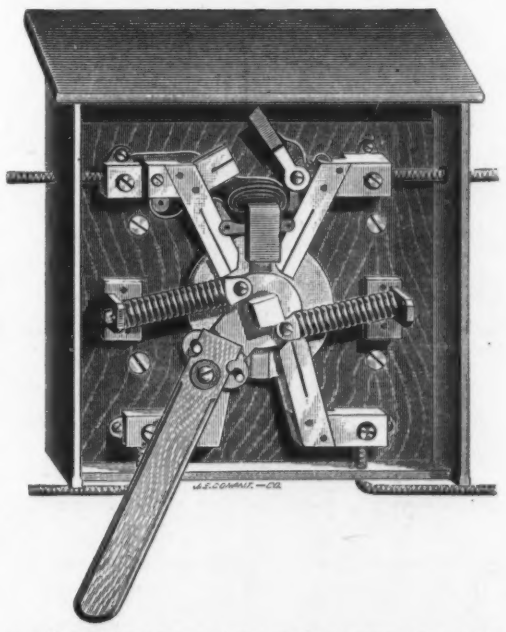


FIG. 2.—NEW BERNSTEIN SERIES INCANDESCENT LIGHTING APPARATUS.

distance between the Scilly Islands and the Land's End is about 22 miles, the maximum depth of water 40 fathoms, the bottom hard and rocky, the tide strong, and in heavy gales the sea tremendous, the locality being exposed to the whole Atlantic swell.

There are cables running a short distance north of the Scilly Islands and landing at Land's End. These cables, the shore-ends of which weigh about 20 tons per mile and the intermediate about 10 tons per mile, are in a depth of water about equal to that in which the hempen cord, above alluded to, was attempted to be laid. Notwithstanding their weight, these cables have been broken not less than five times during the last four years.

One could have seen at a glance, by referring to the charts, that the approaches to the Land's End are extremely dangerous. Will the writer in the *Electrical Review* claim for those who selected such a track, that they were both "*scientific* and *disinterested?*"

Is it necessary again for us to state that the hempen cable we advocate is intended for deep water only? We protest against the failures made 20 or 30 years ago being used as arguments against success now. Is it to be inferred that what A failed to accomplish then cannot be made a success by B now?

How is it that our discovery of the principal cause of rupture to iron cables is never alluded to, whilst the most trivial events in connection with shallow water cables are continually brought forward as arguments against hemp-covered deep-sea cables?

SAMUEL TROTT.
F. A. HAMILTON.

MID-ATLANTIC, March 12, 1889.

Mr. Websters's Electrolytic Treatment of Sewage.

Our English correspondent writes as follows: The startling proposal which was made some little time ago by a Mr. W. Webster to purify the 150 odd million gallons of London sewage, one-half of which is daily discharged at Crossness, by means of electrolysis, is probably within the recollection of many of your readers. Mr. Webster's novel idea was received, and naturally so, with considerable skepticism in electrical circles, but I think the outward and visible proof of the practicability of the electrolytic treatment of sewage, which was witnessed last week at the Outfall Works at Crossness will go a long way to converting the skeptics. Since he read his paper upon this subject before the Society of Municipal and Sanitary Engineers, Mr. Webster has erected at his own expense a temporary plant capable of dealing with a million gallons of sewage

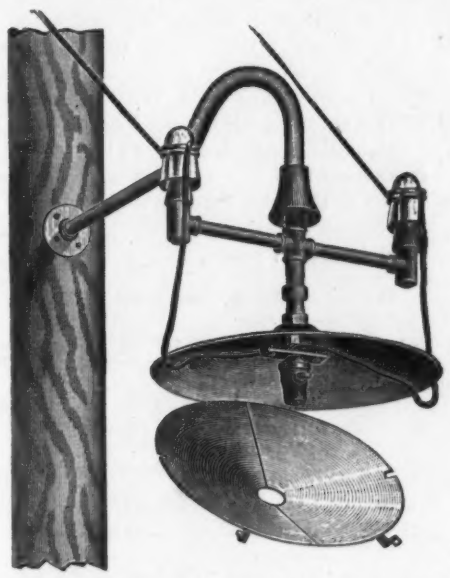


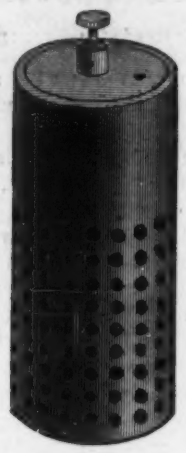
FIG. 4.—NEW BERNSTEIN SERIES INCANDESCENT LIGHTING APPARATUS.

per diem, and it was these works that were recently visited by a large body of members of the daily and of the technical press. The plant comprises two ancient 20 h. p. nominal engines, and a fine Edison-Hopkinson dynamo, capable of yielding about 1,600 ampères and 25 volts at 300 revolutions. The current from the dynamo is led through resistance frames to a wooden shoot, 400 feet long. Into this shoot, which is fitted with wrought-iron plates serving as electrodes, the sewage is discharged. In traversing the shoot, which it does in ten minutes, the sewage comes thoroughly into contact with the plates, and it is there taken into a settling tank, and the effluent is subsequently drawn off. The current density employed in the shoot is about one ampère per 11 square feet of surface, the total current being 500 ampères. The Webster process, as it will probably be remembered, depends upon the fact that ferrous salts have a great affinity for organic matter. When the current is passed through the shoot, the iron compounds precipitate the organic substances suspended in the sewage, the flocculent precipitate being then carried to the surface by the streams of hydrogen bubbles. When the sewage is passed into the settling tank, the precipitate loses all its hydrogen in an hour or so and sinks to the bottom. The liquid which is then passed into the river is in such a pure state that Mr. Webster has stated his willingness to drink it, and even Sir Henry Roscoe thinks it is too good to throw away. According to Mr. Webster, 27 h. p. are capable of treating a million gallons in 24 hours, and the amount of iron consumed is not more than 2 grains per gallon, or about 10 tons per diem for the whole 150,000,000 gallons of metropolitan sewage. Judging by the actual working expenses of the small experimental plant now running at Crossness, the total cost of the process per million gallons amounts to 13s., or about £36,000 per annum for the whole sewage of London. What the actual cost of the present chemical treatment of sewage is it is difficult to ascertain; but it is certainly very inefficient and it involves great expense. I am, therefore, inclined to anticipate a useful future for this latest application of electricity.

The "National Galvanic" Open Circuit Battery.

With the object of increasing the efficiency as well as the life of the ordinary Leclanché, the National Galvanic Battery Company, of this city, have recently introduced an improvement of the porous cup heretofore employed. The new cup, which is shown in the accompanying illustration, consists of a vitrified body, which is perforated; and all the cups are perforated alike so as to obtain uniformity of action. Through the network thus formed the solution circulates freely and current is available immediately upon the immersion of the cup in the liquid.

In addition to the usual lead terminal head is a supplementary piece of platinum wire, which, being unoxdizable, allows the cell to work until the crushed carbon



The "National Galvanic" Open Circuit Battery.

and oxide of manganese is thoroughly reduced. Tests of the battery, made by Mr. John A. Seely, electrician of the Metropolitan Telegraph and Telephone Company, show that after a short circuit of over 5 hours the current which was originally 1 ampère had still a strength of .2 ampère. In another test the cell was placed in circuit with a resistance of 150 ohms for over 13 hours, after which it was at once connected with a vibrating bell, which it rang continuously for 137 hours.

Tangent Function Multipliers to be Used with the Kapp Formulæ in the Design of Dynamos and Motors.

BY ALBION T. SNELL.

The armature iron is assumed to be saturated with 26 Kapp lines, or 25,000 C. G. S. units, and the field magnets with 18 Kapp lines, or 17,300 C. G. S. units.

FOR ARMATURES AND FIELDS.

Kapp lines.	C. G. S. units.	Multipliers. Armatures.	Multipliers. Fields.
1	960	1.00	1.005
2	1,920	1.01	1.013
3	2,880	1.01	1.021
4	3,840	1.02	1.041
5	4,800	1.03	1.069
6	5,750	1.04	1.104
7	6,700	1.04	1.147
8	7,650	1.08	1.202
9	8,650	1.11	1.273
10	9,600	1.14	1.362
11	10,560	1.17	1.489
12	11,500	1.22	1.654
13	12,500	1.26	1.891
14	13,450	1.29	2.250
15	14,400	1.40	2.853
16	15,350	1.49	4.624
17	16,500	1.57	7 707
18	17,300	1.79	infinite.
19	18,249	1.96	
20	19,200	2.18	
21	20,169	2.52	
22	21,120	3.05	
23	22,080	3.92	
24	23,049	5.61	
25	24,010	10.82	
26	25,000	infinite	

In using the above multipliers the value of the magnetic resistance of the armature and field is first determined from the drawing or actual measurements, as detailed by Mr. Kapp. A suitable magnetic flux is then chosen. In the armature, say $Z_a = 2\ a\ b\ \mu_a$, where $a =$ the depth of the armature core, $b =$ the length of the iron *less the insulation*, and $\mu_a =$ the number of lines per unit of area. The coefficient of leakage is assumed to be known or can be determined by experiment. This usually varies between 1.25 and 2.00. Z_a is then multiplied by this coefficient, and gives us Z_f, which is the magnetic flux in the field magnets.

The values of the armature and field-magnet resistances have now to be multiplied by the multipliers corresponding to the values of μ_a and μ_f $\left(\mu_f = \dfrac{Z_f}{\text{cross section of field}}\right)$.

We have now $n\ c_1 = \dfrac{Z_f}{k\ R_a + k_1\ r_a + R}$,

and the number of ampère-turns to give Z_f is known.

The "Edco" Storage Car in Philadelphia.

The Philadelphia papers report successful trial trips of the "Edco" storage car, built for the Electro-Dynamic Company, and equipped with the battery of the Electrical Accumulator Company. The *Ledger* of April 11 says:

"The experimental car used yesterday is a trifle heavier than that of the ordinary street car. The two electric motors, with the necessary gearing, weigh about a ton. The battery consists of 88 hard rubber cells, hermetically sealed, and is arranged under the seats of the car. It weighs one and a half tons. This supplies the current for two electric motors, each geared to a separate axle of the car. The motors are made to give 1,000 revolutions a minute, with the full power of the battery, but by the use of gear wheels this is reduced so as to run the car at the ordinary speed of eight to ten miles an hour. The commutator box is so arranged that all the cells may be put in "series" or into two "parallels," according to the character of the work to be done. The driver controls the application of the power by means of a wheel. Each of the motors will give 13 h. p. when the full force of the battery is applied, and this is ample for any work which they may be called upon to do. The company claim that sufficient energy is contained in the 88 cells to run the cars 60 miles, under ordinary conditions. Yesterday during the trip from Forty-ninth street the car ran off the track while ascending a heavy grade and on a curve. The car was stopped and again started, when, without apparent difficulty, it moved over the road and resumed the track. It is stated that the car has made the trip to Darby two or three times, and has made several shorter trips with the one charge of battery, which is not yet exhausted. The car, the batteries and the motors have all been specially designed and built for street railroad service."

Western Union Wires in New York to Come Down.

On April 12 Judge Wallace of the United States Circuit Court in this city rendered his decision in the suit brought by the Western Union Telegraph Company to restrain the Board of Electrical Control from interfering with its wires. Judge Wallace decides that the telegraph company's ground for the desired injunction is not well taken, but he holds that, as regards the wires attached to the elevated railroad structures, the company cannot be interfered with.

"This case," says Judge Wallace, "presents the general question whether certain acts of the municipal authorities of the city of New York respecting matters of grave loca concern done or about to be done pursuant to powers devolved upon them by the Legislature of the State are such an invasion of the paramount authority of the National Government as to render them unwarranted. The mere statement of the proposition shows that the complainant has properly invoked the jurisdiction of this court, and has a right to rely upon its interposition by injunction if the acts of the defendants are thus unwarranted, are injurious to the complainant, and are of a nature remediable by courts of equity.

"Telegraph companies that have accepted the restrictions and obligations of the laws of Congress of July 24, 1866, become, as to government, business agencies of the general government, and are given the privilege to 'construct, maintain and operate lines of telegraph over and along any post road of the United States,' but not so as to interfere with 'the ordinary travel' on such roads. All streets of the city of New York are post roads, because they are letter carrier routes; and all railroads are post roads."

Judge Wallace held that persons and corporations enjoying grants and privileges from the United States, exercising Federal agencies and engaged in Inter-state commerce, were not beyond the operation of the laws of the State in which they reside or carried on business; and it was only when those laws incapacitate or unreasonably impede them in the exercise of their Federal privileges or duties, and transcend the powers which each State possesses over its purely domestic affairs, whether of police or internal commerce, that they invade the national jurisdiction. The statutes which the defendants men were proceeding to enforce unquestionably belonged in the category of police regulations, the power to establish which had been left to the individual States. Applying these principles, it was now to be considered whether the statutes in question or the acts of the defendants under them can be defended under the State power of police regulation, or whether what was proposed to be done exceeded in any respect the boundaries of legitimate regulation and encroached upon the rights of the complainant founded upon the law of Congress or incidental to the nature of its commerce.

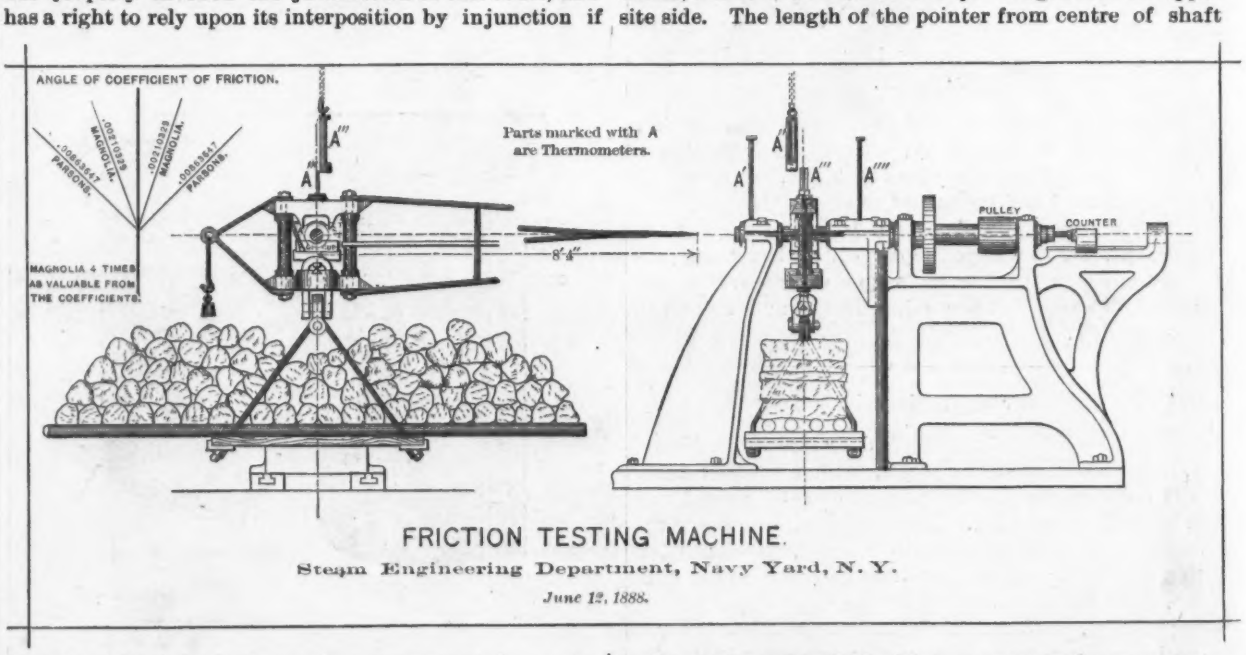
According to Judge Wallace it was not apparent how the regulation proposed impaired in any just sense the privilege granted to the telegraph company by the law of Congress. The privilege to maintain telegraph wires "over and along" post roads was not to be construed so literally as to exclude regulations by the State respecting location and mode of construction and maintenance, which the public interests demand, but is to be construed so as to give effect to the meaning of Congress, which was to grant an easement that would afford telegraph companies all necessary facilities, and which to that extent should be beyond the reach of hostile legislation by the States.

Judge Wallace directed that an order be entered denying the injunction and vacating the stay that was granted regarding the removal of complainants' poles and wires, and granting an injunction against any interference by the defendants with the Western Union's use of the elevated railway structures.

The Magnolia Anti-Friction Metal.

Considerable interest has been aroused of late in the best means of reducing friction in the bearings of dynamos and motors and similar high speed machinery in use about electric stations. In a recent issue we described a machine designed to test the efficiency of different anti-friction metals, and on this page we illustrate the machine employed in the Brooklyn Navy Yard for that purpose. The machine is similar to that used by Mr. Beauchamp Tower, of England, in his friction experiments made for the Society of Mechanical Engineers, London, England, in 1883 and 1884. It consists of a shaft revolving in suitable bearings, between two of which is a steel journal (keyed on the shaft) on which the test piece is placed. The top half only of the bearing is used for tests by this machine, and which for the tests is lined with the soft metals. The brass sets in a yoke-frame, which incompasses the bearing, to the under side of which is suspended a platform on knife edges. On this platform the weights are placed for producing the pressure on the test bearing.

A long arm, or pointer, of light weight, with a needle in the extreme end, is attached to one side of the yoke-frame, and is counter-balanced by a weight on the opposite side. The length of the pointer from centre of shaft to the needle end is 100 inches. A rectangular pan rests on the lower part of the yoke frame beneath the test journal, in which, when the pan is raised in position, the journal revolves, carrying oil around with it, and thus the bearing is lubricated.



FRICTION TESTING MACHINE.

Steam Engineering Department, Navy Yard, N. Y.

June 12, 1888.

Some recent tests made with this machine are worthy of notice. The trials were made between the "Magnolia" metal, made by the Magnolia Anti-Friction Metal Company, of this city, and the Parsons "White Brass." These tests embrace pressures upon bearings varying from 100 to 600 pounds to the square inch, on a journal having a diameter of 4 inches and revolving at 500 revolutions per minute. The results showed that in the mean the temperature of the Magnolia metal did not exceed 100 degrees Fahr., while that of the "White Brass" averaged 164 degrees Fahr. It was also shown that the coefficient of friction of the two metals was 0.0021 and 0.0086, respectively, or 4 to 1 in favor of the Magnolia. It is as the result of such tests that "Magnolia" enjoys its popularity, and is now used by one of the largest electrical concerns in this country for the bearings of its dynamos, motors, etc.

The New Westinghouse Compound Engine.

The Westinghouse "Standard" and "Junior" automatic engines are without doubt so familar to our readers by their widespread employment in electric light stations that any description of them would be superfluous at this time. But in keeping with the progress of the times the Westinghouse Machine Company, of Pittsburgh, Pa., have recently brought out a new compound engine which merits attention on account of its great economy in operation and the simplicity of its construction.

The accompanying illustrations, Figs. 1 and 2, show the engine in front view and in section, respectively, from which it will be seen that it resembles in general form the Westinghouse "Junior" automatic engine, and that the mechanical characteristics of the single acting engine are retained here, one cylinder being enlarged to 3½ times the area of the other.

The valve chest lies across the top of the cylinders, being the construction which admits of the least possible clearance in the low-pressure cylinder. The valve chest, shown in Fig. 4, is in one piece, the various steam passages being chambered in it. The valve seat is in the form of a bush, in which the ports are cut, not cast, to an exact register. This bushing is reamed out and forced steam-tight into its bored seat. This form of construction has many advantages. The casting is greatly simplified, avoiding all chance of porousness, sand holes, and other defects which are liable to cause concealed leaks. The valve seat can be made perfect, and the parts registered exactly, on which latter fact depends the perfection of the steam distribution and the consequent economy of the engine. And lastly, the valve seat can be easily and cheaply renewed when worn.

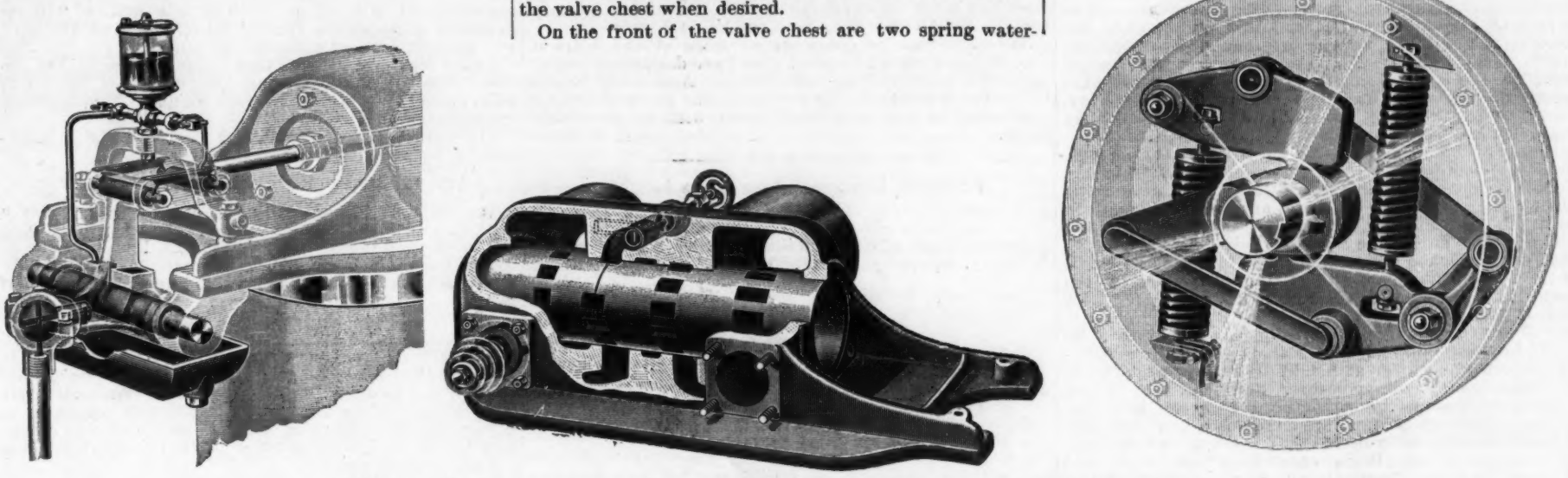
The valve chest also contains a small by-pass valve controlling a cored passage, by which live steam can be admitted to the low-pressure cylinder, to turn the engine over its centre when starting. The steam and exhaust connections are on the side of the valve chest towards the back of the engine, bringing the throttle valve into convenient position, and admitting of the ready removal of the valve chest when desired.

On the front of the valve chest are two spring water-relief valves, Fig. 4, of large area and having soft metal seats. These valves are adjustable to any pressure while running and practically insure the engine against damage from water. The passages for the indicator connections are through the centre of these relief valves, and are stopped by the usual plugs. The back valve chest head can be removed, and the condition of the valve inspected while running,—a valuable feature.

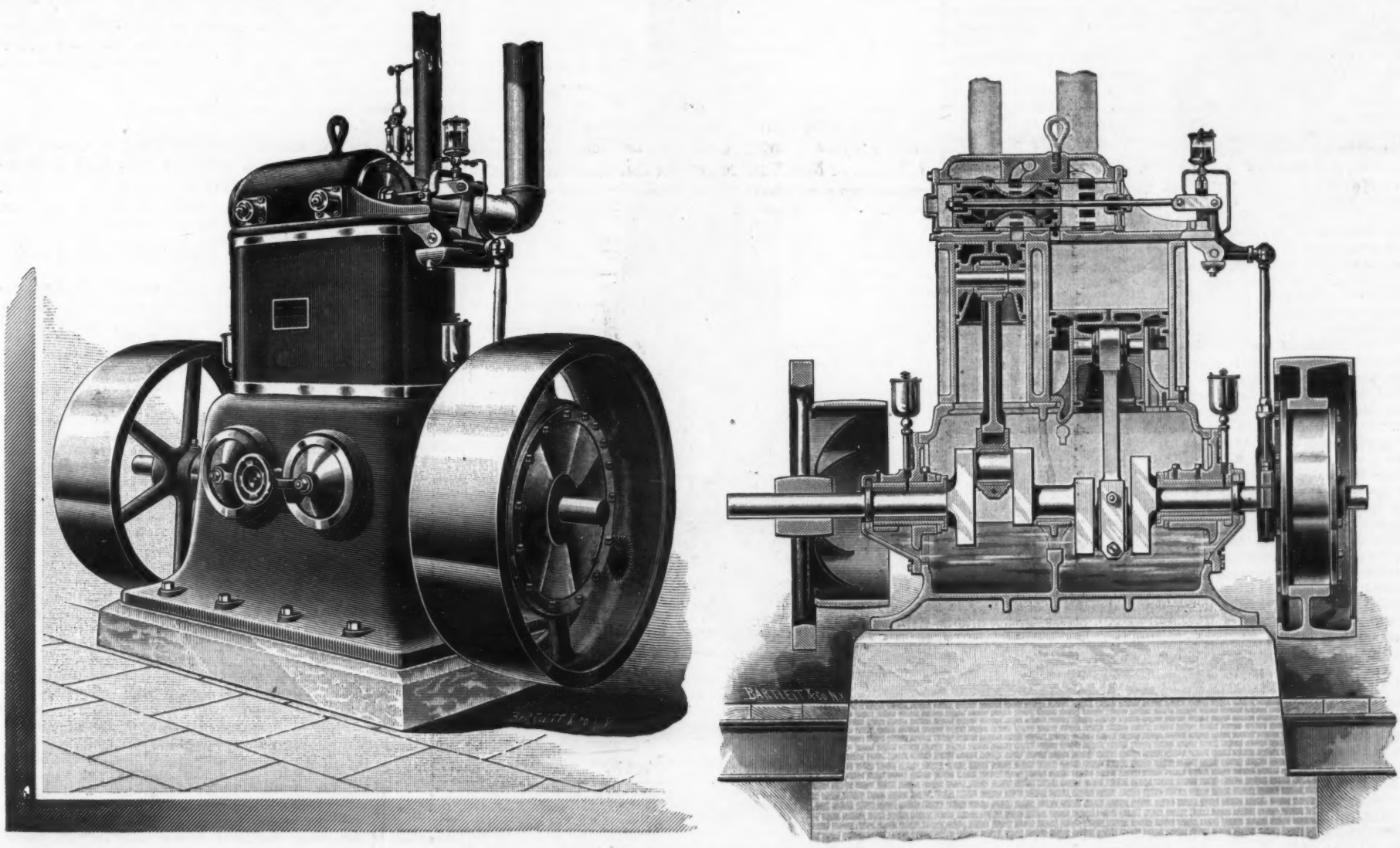
The valve is actuated by a single eccentric controlled by a shaft governor, shown in Fig. 5. Recognizing the great practical value of a constant and profuse lubrication of the governor, all its parts have been inclosed in a case which is filled with oil when the engine is first set up, and requires no further attention for an indefinite period. The eccentric alone is outside of the governor case, being carried on a shaft running through a sleeve, and bearing against stops when at full throw.

The lubrication of all the pin connections and of the eccentric itself is automatically performed by a sight-feed cup carried on a yoke over the rocker arm, Fig. 3. One feed pipe drops oil into a channel milled in the upper edge of one of the links and long enough to allow it to take oil under the full throw of the eccentric. From this channel holes lead through the two pins in the rocker arm and valve steam head to their respective bearings. The other feed pipe drops oil directly into a chamber surrounding the rock shaft, from which the surplus flows through large passages drilled in the rocker arm onto the ball and socket joint, and thence down through the hollow eccentric rod into a pocket in the eccentric strap. The used oil collects in another pocket underneath the eccentric strap. A drip pan under the rock shaft catches any waste of oil, which can be drawn off occasionally by the pet cock. The hole on the side of the bracket is for a stud to carry an indicator rig.

The operation of a compound engine by means of a single valve and eccentric will be recognized as a great improvement. Tests show that with the engine non-condensing about 22 pounds of steam are required per horse-power, using steam at 120 pounds pressure in an engine delivering 210 h. p.; while at 50 h. p. the consumption was 28.8 pounds of steam per h. p., and 30 pounds of steam when 60 pounds steam pressure was employed. When used condensing, the steam consumption did not exceed 20½ pounds per h. p. and fell as low as 18.1 pounds. These tests were made with an engine 14 × 24 × 14 inches, of the new type. These compound engines are built in sixteen sizes, ranging from 5 to 500 h. p. They are designed to be run at high speed, the velocity of piston in feet per minute ranging from 333, for the engine with a stroke of 6 inches, to 700 for a stroke of 20 inches.



FIGS. 3, 4 AND 5.—DETAILS OF THE NEW WESTINGHOUSE COMPOUND ENGINE.



FIGS. 1 AND 2.—THE NEW WESTINGHOUSE COMPOUND ENGINE.

Preparing for the Great Exposition in Paris.

(From our Special Correspondent.)

Paris, France, March 28, 1889.—The year 1789, with its great French Revolution, is a famous one in history, and its centennial anniversary will be celebrated in a manner befitting the occasion. The Paris Exposition of 1889 will be a grand affair, as everybody knows, but how grand no one can appreciate until the buildings and grounds themselves are seen. As one goes through them, from end to end, they stretch out and out, without any apparent limit. The buildings are wonderful structures, and reflect great credit upon their designers. They are situated on the Champ de Mars, opposite the Palais du Trocadéro—where are so many beautiful pieces of statuary, the wonderful cascade and fountain, and fine museum; as well as a very large organ and a music hall which seats 6,000 people. The Trocadéro was erected prior to the exposition of 1878, and will be included among the exposition buildings this year. The main portion is a circular edifice 190 feet in diameter and 180 feet high, flanked by two minarets 270 feet high, and surmounted by a dome. There is a curved wing at each side, the whole making one immense crescent 650 feet long! Sightseers, entering at this end of the grounds, after going among the adjoining exhibits and eating American corn in a building composed entirely of this article, can cross the River Seine by means of the Pont de Jéna to the main portion of the Exposition. It is here you find yourself at the very foot of the great Eiffel Tower, which looms up in the sky for 1,000 feet, or just twice as high as the Great Pyramid in Egypt, and 450 feet higher than the Washington Monument. So much has been said and written about this truly wonderful structure and its great height that the first sight of the tower itself is disappointing. Standing near it and looking up, it seems incredible that the top can be so far away. All the proportions are on such a grand scale, and it stands so entirely by itself, that there is no standard to compare it by. It is only from the fact that it can be seen from almost any part of Paris, and for miles in the surrounding country, that any realization of its immense elevation can be arrived at. On a clear day, from the top of this tower, it is possible to see sixty miles in any direction. Eiffel built the tower for $1,600,000 and has sold it for $1,000,000 to a syndicate which is to keep it in position for twenty years. It will be lit by electricity. There is a great deal of talk here about a lighthouse tower which Eiffel is now designing for New York harbor, which is to exceed this one in height by 500 feet. What likelihood there is of this rumor being founded on fact, it is hard to say, but Americans do not like to take the back seat in anything, even when it comes to lighthouses. Out of the twenty million visitors expected at the Exposition, fully five per cent. will want to ascend the Tower, and as a nice little price of two dollars will be asked for the ascent in the elevators, the syndicate will probably net a comfortable sum.

One hundred and fifty acres of ground are inclosed for exhibition purposes, and that portion which is not covered by buildings will be beautifully laid out in gardens, terraces and walks. The government has evidently put a premium on good workmanship and artistic designing, for, from first to last, the buildings are not only most admirably adapted to the uses to which they are put, and exceedingly well built, but they are pictures in themselves. French artists and decorators, besides French fashion makers, are world-famous, and every effort has been put forth to make each available space contribute to perfect harmony of color and form. The finest artists in the world are engaged in frescoing ceilings, painting beautiful plaster casts and staining the glass used in the roofs and ends of the large buildings.

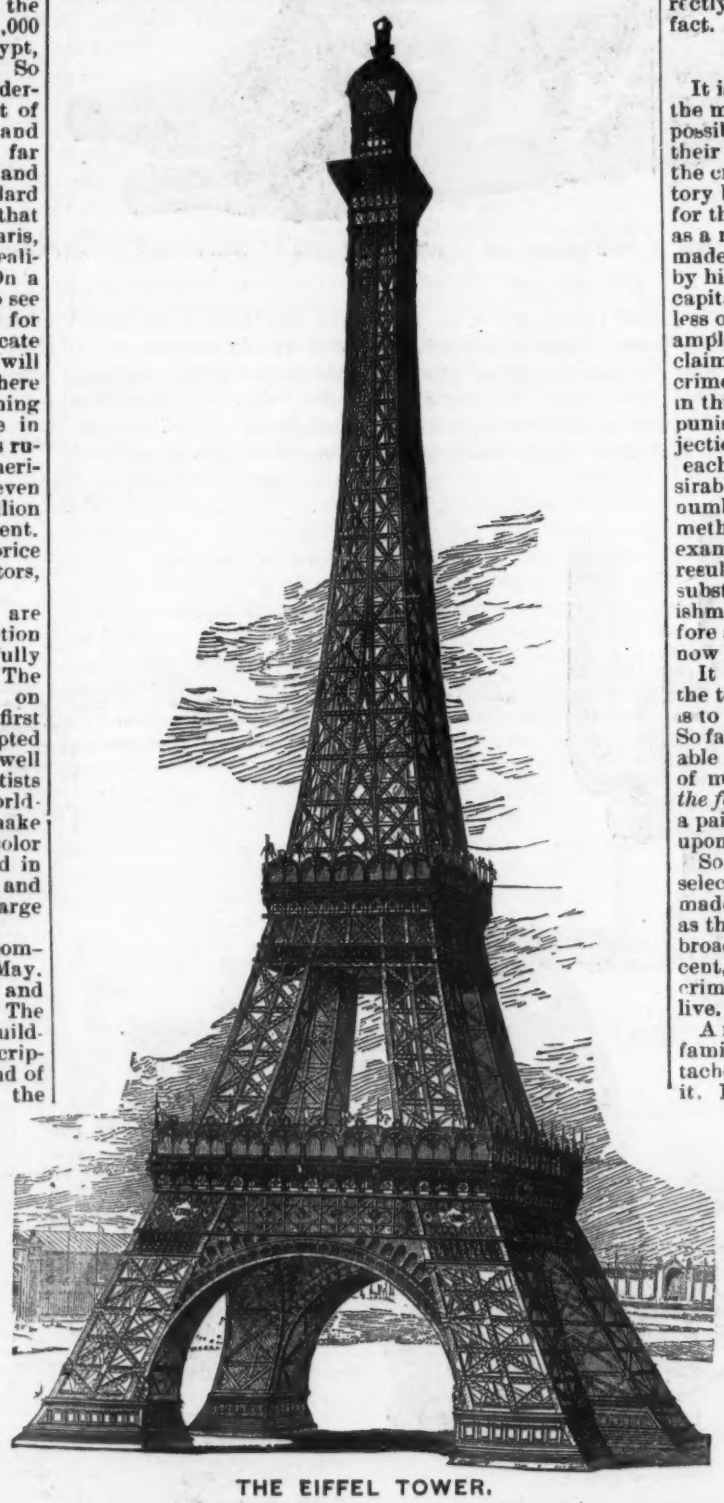
Nine thousand men are working day and night to complete the buildings and grounds before the fifth of May. The principal buildings are those used for the fine and liberal arts, the diverse exhibits and machinery. The machinery palace is the largest and most important building. Much has been said of it, but no adequate description can be given. It is at the extreme southern end of the grounds and is 1,380 feet long by 380 feet broad, the ridge of the roof being 150 feet from the floor. It is an immense building, but its great size cannot be fully appreciated until one sees the workmen up in the trusses at the roof where they look like pigmies! The roof is supported by magnificent arches which rise from the floor on one side and make an unbroken sweep to the other. Only a portion of the roof is solid, and that is decorated with the coats of arms of the principal cities of the countries represented at the exposition. These are made of plaster, molded into beautiful designs and painted before being placed in position. So well is the painting done that it is almost impossible to distinguish the bas-reliefs from the plane surfaces. The arms of the city of Paris are placed in the central nave on the south side of the building, while, as a mark of honor, the arms of our fair City of Washington are placed directly opposite. Paris is flanked by Marseilles, Lyons, Lille and Bordeaux, while Washington is in such good society as London, St. Petersburg, Vienna and Pekin. Then Rome, Copenhagen, Christiana, Mexico, Teheran, Athens, Lisbon, Brussells, Tokio, Buenos Ayres, Stockholm, Rio de Janeiro, Bucharest, Luxemburg and others occupy the less important positions at each side of the centres.

The remainder of the roof is fitted with heavy plate glass, the slabs of which appear from the floor to be about three feet by ten or twelve inches. As a matter of fact, they are seven feet long and two feet wide! A gallery fifty feet wide runs round the entire building at a height of thirty feet, and will be used for exhibits of light machinery, such as sewing machines, etc. From end to end stretch four long lines of shafting, from which all the machinery in the building will be run. This shafting is supported on a trestle work, which looks more like the New York Elevated Railway structure along Greenwich street than anything else. These four lines of shafting divide the building into five almost equal spaces, so that all parts of the floor can be reached by belting. The supporting structures are surmounted by a single rail, and each *pair* forms a track on which an immense traveling crane, run by electricity, can be moved from end to end of the Palace in setting up some of the very heavy pieces of apparatus which are to be put in. These cranes are made by different concerns, and are exhibits in themselves.

A visitor going through the buildings now sees nothing but confusion, disorder and chaos. A number of exhibits have not arrived yet, and much flooring remains to be put down. Cases, boxes, barrels and castings are piled up twenty and thirty feet in every available spot, and it seems as if no headway could ever be made against such an accumulation of material. Many exhibits have been commenced, but none are completed. Everybody is working with the greatest energy, and apparently hopeless as the case may seem to the uninitiated, the exposition will be ready for its visitors when the time for opening arrives. Surprising, also, as it may appear, the buildings and all the work done on them and the grounds have cost but nine million dollars, a sum which would not more than half cover the expenditure which would be necessary should the buildings have been erected in America.

The directorate is composed of some of the smartest men in the French Republic, who have done their best to make this exposition a grand success. And it will be one of the finest the world has ever seen, and one which those concerned in can look back upon with commendable pride.

E. W. H.



THE EIFFEL TOWER.

Proposed Electrical Executions in Ohio.

BY ALLEN R. FOOTE.

Every person who has a dollar invested in the electrical industry, especially manufacturers, is vitally interested in having all bills relating to the uses of electricity that are introduced into the various State legislatures carefully scrutinized.

After giving some study to the subject I am of the opinion that little or no legislation hurtful to the electric industry could have been enacted if there had been a timely, well-sustained and well-organized effort to give Senators and Representatives proper information upon the subject of electricity, the methods of its applications and its uses. I think all antagonistic legislation could have been averted in the past, and can be averted in the future, if those who create opinion, and those who formulate opinion into law, are made familiar with and are kept posted regarding the subject in all its bearings. I have spent a week at Columbus to familiarize myself with the electrical legislation undertaken in this State during the present session of the General Assembly. I found several bills that had been introduced.

Principal among them, and the only one I shall speak of in this article, is Senate bill No. 185, introduced by Senator William J. Rannells, "Providing the mode of inflicting punishment by death," the mode provided being to execute criminals by electricity. This bill passed the Senate Jan. 23, by a vote of 20 to 3. When reported to the House it was referred to the Judiciary Committee, of which Mr. Walter W. Merrick was chairman. On April 5 Senator Rannells had a hearing before this committee. He made an effort to have it report favorably on the bill and press its passage in the House. As I had but just arrived in Columbus and was unacquainted with the members of the Legislature, I could not immediately follow Senator Rannells before the committee. I asked to have action delayed until the 9th. I then made the acquaintance of such members as I conveniently could, and discussed with them the various aspects of the question, giving them many views of the subject that had never been brought to their attention. I also prepared a written argument to be filed with the proceedings of the committee.

I was present at the meeting of the Judiciary Committee on the 9th of April, at which time a motion "to indefinitely postpone the further consideration of the bill" was adopted without a dissenting vote.

I have reason to suppose that Senator Rannells had no other objects in view, in connection with this bill, than what appeared to him to be well-founded humanitarian considerations.

The written argument which I filed with the committee is at follows:

THE EXECUTION OF CRIMINALS BY ELECTRICITY.

The proposal to substitute the electric current for a rope, as a means of legal execution, is based entirely upon the affirmation that by this means a painless death can be caused instantaneously. This affirmation involves, indirectly, a question of sentiment, and directly a question of fact.

The Question of Sentiment.

It is affirmed by those who urge the proposed change in the method of execution, that it is desirable to do all that possibly can be done for the comfort of criminals. By their manner of treatment, they practically apologize to the criminal for executing him. Since the records of history began, capital punishment has been society's antidote for the crime of murder. It has always been looked upon as a means of protection to society through the example made of the criminal. The example made of the criminal by his execution is the basis upon which the law requiring capital punishment rests. Every effort to make executions less objectionable to the criminal tends to weaken the example until further progress in that direction may be claimed as an effort to encourage rather than discourage crime. To be consistent, those who advocate further effort in this direction should advocate the abolition of capital punishment, instead of seeking to render it still less objectionable to the criminal. The experience of society teaches that a scientific use of the rope is the limit of desirable amelioration of the condition of execution. In a number of States it has been considered that by this method of execution, the quality of protection from the example has become so vitiated as to lose its value. As a result, those States have abolished capital punishment, substituting a sentence of imprisonment for life as a punishment more to be feared than death by hanging, therefore a better protection to society than the death penalty now in force.

It is well to consider in this connection the fact that the tendency of all philosophical and theological teaching is to remove from the mind the old-time horrors of death. So far has progress been made in this direction, it is reasonable to affirm that in a large number if not a majority, of minds, *the pain of death is to-day a greater terror than the fact of death.* If this be true, to guarantee a criminal, a painless and instantaneous death will place a premium upon crime!

So long as capital punishment is required by law, the selection of the means by which the execution shall be made must have reference to the rights of society as well as the comfort of the criminal. The rights of society are broad and fundamental. They are the rights of the innocent, unoffending millions, against the rights of one criminal who, by his own act, has forfeited his right to live.

A rope is of such a character and its myriads of uses are so familiar to the people, that no stigma or disadvantage attaches to its use for execution. There is no mystery about it. Being used for the purpose of execution creates no objection to its use for any other purpose. This is not true of electricity. The people, as a whole, are entirely ignorant of the character of the different electric currents, the multitude of uses to which they may be applied, the manner in which results are accomplished by them, and the specifications of the apparatus by which they may be best used. Mystery envelopes the unknown. Sensational stories always treat of subjects about which there is the least general knowledge. For these reasons the designation of the use of electricity as a means of execution tends to create the impression that its use is very dangerous. Such an impression is a drawback to its general use; a result detrimental, in the first instance, to those interested as scientists and manufacturers, and in the second, and by far the most important instance, to the vast number of people who can be benefited by its wonderful and as yet but half-told advantages. These facts are well known to those who watch the progress of events from the standpoint of their interests. The effort to have criminal executions made by the use of electricity was sustained in the New York Legislature by those whose invested interests are antagonized by the progress made in rendering the use of electricity available for the services of man. But for the influence of such interested workers, working for their own interests instead of the welfare of society, the act would not have passed. As soon as it was passed another set of interested parties came to the front, and made a tremendous effort to fasten the stigma of its selection for criminal executions upon a certain electrical system. The opportunity for this arose from the fact that no Senator or Representative in the New York Legislature—nor is there such an one in the Ohio Legislature—was able to give an intelligent description of the apparatus to be used. The truth is, at the time the New York law was passed, there was no such apparatus known to science. The spirit of trade seized upon a questionable sentimentality and used it as a cloak for the accomplishment of its own purposes. It succeeded in getting the New York Legislature to pass a law that execution should be made by electricity and then to incur the expense of experiments to be conducted by a special committee, to find out how it might be done. This committee placed itself at the disposal of those represent-

ing a certain system. Every experiment has been heralded over the country as an evidence of the danger in electric currents and of the special danger in the alternating current. Those most familiar with the subject know that its agitation from the beginning until now, that the brutal experiments on unoffending animals, and the fear of danger from the use of electricity that has been engendered in uninformed minds, has already caused more suffering by the innocent unoffending millions, than can be saved to condemn criminals by a change in the method of execution, in a hundred years. Human sympathy should be shown for humanity and not for the exceptional few who have, to a certain degree, forfeited all right to sympathy. Society should be protected from acts of legislatures upon subjects concerning which senators and representatives know absolutely nothing.

If the general knowledge of the character and uses of currents of electricity was as universal and thorough as such knowledge is of a rope, the evil design with which this law for electrical executions has been urged by interested parties, and the effort to stigmatize a certain system as especially dangerous by its selection for that purpose, would never have been made. No representative body, no person desiring to maintain a reputation as a scientist could be found to stultify himself by undertaking such advocacy. It would be like attempting to get a legislature to pass a law compelling the sun to revolve around the earth in the good old-fashioned way when men grew old and died with less knowledge than children now have.

The Question of Fact.

The legislator who is asked to vote in favor of the enactment of a law requiring executions to be made by electricity, is invited to do so on the strength of representations that electricity can be relied upon to invariably cause a painless and instantaneous death. This statement, however, is not accompanied by the specifications of any apparatus that has been shown to do this practically, or even of any that competent scientists are willing to affirm is properly designed to do so theoretically. Is it the business of the State to assist those interested in a certain electrical system, or those who seek to gain notoriety by making a specialty of magnifying accidents, by using its resources and giving its sanction to experiments on animals or human life? Is it not disgraceful to do this in the name of humanity and for no other purpose than to render executions more comfortable? That these things have been done and must continue to be done, if executions are to be made by electricity, is sufficient evidence that there is no scientific foundation for the claims made.

Since the object sought by certain interests in having electricity used for executions, was to associate the idea of very great danger with the use of electricity for the purpose of preventing its general adoption; it is due to the millions who can be benefited by its use, to say to them that, all conditions fairly considered, electricity is to-day the safest agent of power that science has tamed for the use of man.

Since the adoption of the alternating current for the experiment of criminal execution has been seized upon as a weapon to destroy the commercial value of apparatus using that current, by those interested in the sale of competing apparatus, it is due to those now owning such apparatus, and those who can be largely benefited by its use, to say to them, that the representations made have no foundation in fact.

The truth is, apparatus can be devised by which either of the two systems, the constant or alternating current, can be applied to the uses of execution. In this respect there is practically no difference between them. A law designating the use of one or the other, to be impartial, should state this fact. But, as the gains are questionable and the losses are decided, no law directing the use of electricity for criminal executions should be enacted.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, April 15, 1889.

Mr. E. W. Carritt, manager of the electrical construction department of the Mutual District Company, says that the department has work enough on hand now to keep it busy till late next fall, installing electric lights and wiring for stations of all the companies. Household specialties are their biggest card.

The Callender Company.—The affairs of the Callender Insulating and Waterproofing Company, which have been in an embarrassing condition for some time past, may yet be straightened out to the satisfaction of the American creditors, provided the negotiations for the reorganization of the company on an American basis are carried through. It is said that the English creditors are willing to waive the enforcement of their claims until the American creditors' claims have been satisfied if the reorganization can be effected.

The Westinghouse Electric Company have recently issued a neat little agent's circular containing a list of the hundreds and hundreds of patents which they now control, either by direct ownership or by lease. The pamphlet is prefaced by a statement as to the situation of the electric lighting patent litigation. The pamphlet is, by the way, a most interesting exhibit of the range of electrical invention, and of the number of inventors who have been engaged in the field of late years. Some of the 650 patents controlled by the company go back to 1874.

Orange, N. J.—The Excelsior Company's electric light system, which was introduced not long ago at Orange, N. J., has given great satisfaction, and the Mayor of the city, in his last report to the Common Council, says: "Keeping abreast of the times, and the improvement in public illumination, gas was displaced by electricity, and now our streets are lighted with so clear, steady and bright a light that it is surprising our people have endured the old-fashioned method for so long a time without more complaint." This city started with 160 arcs and at least 200 are now required.

Mr. C. J. Hirliman, of the Improved Porous Cup Battery Company, 89½ Greene street, was in Philadelphia during the past week, and speaks highly of his kind reception. He returned well pleased with orders for large quantities of his cups. He found the goods well-known in Philadelphia, and the orders simply awaiting his call for them. Hirliman will shortly visit Boston also, as well as Providence and Worcester, and Utica, Auburn, Albany, etc., in this State. The demand is so brisk that it is simply amazing where all the batteries go to. At the present rate of demand it will not be long before every man, woman and child in the United States will be credited with at least one cell per capita.

Mr. A. L. Bogart, the well known manufacturer of electrical gas lighting apparatus and electrical supplies of every description, 22 Union Square, this city, has just issued his April catalogue, a handsome pamphlet of thirty pages, illustrating the apparatus which he handles, more particularly his familiar system of electrical gas lighting, including the multiple system and the hand-lighting, as well as plain pendant, ratchet pendant burner, automatic burner, etc. The extent of the work done by Mr. Bogart is now something enormous, yet the demand seems to increase all the time; and the result is that the concern is busier than it ever was before, orders pouring in from all parts of the country for all the old and new styles of apparatus.

The Eco Watch Clock.—Mr. C. D. Bernsee tells me that he is meeting with extraordinary success in the introduction of the Eco watch clock for the protection of buildings and all kinds of property. It necessitates a watchman being on hand to indicate on his clock the time when he performed his patrol duty, and every station gives the record of this fidelity. Mr. Bernsee furnishes with this clock small magnetos in place of batteries. Among the contracts closed in one week are those for the Union Square Theatre, Hearn & Son's dry goods house, 14th street, Bishop Gutta Percha Company, Electric Construction & Supply Company, Dodge & Company's lumber yard, Jersey City, the Importers' and Traders' National Bank, and the Bixby big blacking establishment.

The Atlantic Watch Case Company, 9 Maiden Lane, have just put upon the market a very handsome patented anti-magnetic nickel case for watches. These cases are of nickel rolled on highly anti-magnetic metal, resisting all magnetic and electrical influences and for that reason specially recommended for use by all persons engaged actively around dynamos and motors, as well as to the public in general. Owing to the strength of the materal it is practically impossible to injure these cases. They are dust proof, being screw backed and bezeled, and in price but a little higher than the ordinary German silver case now sold as nickel. With these cases it is not necessary to run any risk in altering or fixing up the works, and they are so pretty and tasteful that any man would be glad to wear them.

Testing of Magnolia Metal.—Matters are quite lively with regard to the recent tests of anti-friction metals, and Mr. Miller, of "Magnolia" metal fame, has called my attention to a remarkable test made at the Erie Basin Dry Docks in Brooklyn, where bearings of Magnolia anti-friction metal, run at 2,000 revolutions per minute, under 604 pounds pressure to the square inch, gave an average temperature of only 113 degrees Fahrenheit. This test was successfully made against all the other well-known metals in the field, and at a later test Magnolia reached only 216 degrees when one of the other best known melted out at 310 and clung to the bearings. The Ohio State University has also tested the Magnolia successfully against leading competitors, and the metal enjoys also, Mr. Miller informs me, the indorsement of the United States and German governments as the result of their investigations on the subject.

The Continental Dynamo Company.—Mr. Peter Klaus, the electrician and manager of the Continental Dynamo Company, 42 Exchange place, with factory at 162 West Twenty-seventh street, has just completed some successful tests of their new 75,000 watt dynamo for electrical deposition. The machine was tested on a continuous run of six hours at a speed of 500 revolutions, and gave an efficiency, it is claimed, of 96½ per cent. The journals, bearings, armature, etc., ran cool during the tests, which, before they were completed, amounted to an actual run of 20 hours. The company has on exhibition now a dynamo of 3,000 ampères in full running order for depositing copper, and they have in stock and make to order all sizes of machines for metallurgical work, as well as for arc and incandescent lighting, ranging upwards from machines of 50 incandescent capacity or 8 arcs.

Mr. Eugene T. Lynch, Jr., has entered the professional field as a consulting electrical engineer. He makes a specialty of estimates and contracts for any system of arc and incandescent lighting, whether for central stations or for isolated plants; also furnishes plans, specifications and estimates for electric railroads of all the various systems and methods. Mr. Lynch, who received his technical training at Columbia College, needs no introduction to any one in the electric business,-being so well known, not only as a prominent member and officer of the National Electric Light Association, for which he has done excellent work, but as having had the active management for a long time of the local United States Company. Mr. Lynch is one of the best equipped of the young electrical engineers, and will undoubtedly secure a large share of the work to be done. He has opened offices at 120 Broadway.

The Bergmann Electric and Gas Fixture Company, which was recently organized, is already busily at work in its fine new building at 527, 529, 531 West Thirty-fourth street. The building is 75 feet front, 50 feet deep and 7 stories high, and will have an extension running back 85 feet more. Mr. S. Bergmann is president of the concern, Mr. R. F. Caldwell vice-president, and Mr. P. H. Klein, Jr., secretary and treasurer. The gentlemen are well known in the business, and it goes without saying that they will make a great success of their new enterprise. They are thoroughly qualified in every particular for the business of manufacturing electric light and gas fixtures, and their productions will at once take a very high place in the market. Not only will the workmanship be good, but the artistic element in the designs will be paid special attention to. The firm have already secured some very handsome contracts, and are actively engaged in filling orders.

The Electrical Construction and Supply Company, 87 Liberty street, report an active demand and sale for the improved Simplex arc lamp for direct and alternating circuits. Mr. F. E. Kinsman, I understand, improved this lamp so much that it is hardly the same lamp since the company began to manufacture it themselves. The company have recently brought out a new focusing lamp, of which several are in use on steamers plying in Western waters. The company are also selling Simplex insulated wires and cables, and installing some large plants where thousands of feet of this wire are being introduced. The big new Austin Corbin building at Broadway and John street, has from 12 to 15 thousand feet of Simplex wire put in by this company, in addition to the Clark wire mentioned last week. The building is completely wired for elected light, telegraph, telephone, district messenger and stock ticker service. The main lighting circuits are No. 0000 Simplex wire. The Carteret Club, Jersey City, has just been wired by this company with Simplex wires for over 150 lights, to be supplied from the new Westinghouse central station.

The India Rubber Comb Company, of No. 9 Mercer street, this city, guarantee all their hard rubber electrical specialties to consist of nothing else but pure rubber. No composition, they say, enters into their goods in any shape or form. Their experience in this business, extending over a period of 30 years, convinces them that thoroughly insulating hard rubber unless pure cannot be found—as the result of the adulteration of rubber is deleterious compounds—and they pride themselves on the fact that their pure rubber goods have secured a world-wide reputation, including insulators of all kinds, battery cells, etc. The company's facilities are enormous, and cannot be overtaxed in the manufacture of battery cells, hard rubber tube and rod, sheet, backboards and bases for telephone, telegraph and electrical instrument purposes, magnet heads and covers, pins, brackets, screw insulators, cut out bases, dynamo rings, commutator sections, parts of armatures, field rings, bases for dynamos and motors, binding posts, rings, and an endless number of details of this character, all of which can be had on the shortest notice. Special goods are also made to order on short notice,

Activity in Electrical Supplies.—Talking last week with Mr. C. Baxter, of H. E. & C. Baxter, 18 Fulton street, Brooklyn, manufacturers of household and miscellaneous electrical specialties I found that the outlook was very encouraging. Mr. Baxter told me, as an evidence of the good market offering, that building permits taken out in Brooklyn last week ran up to nearly one million dollars, to be spent on buildings, many of which would require electrical apparatus, wiring, etc. Orders for the Baxter gravity drop annunciator and burglar alarms in special designs are very large, and having their own cabinet makers, with all the latest improved machines for this work, they are enabled to turn out these goods in any quantity and on a very economical basis. The staple goods in this line are largely called for in oak, ash, walnut and cherry, but they have lately been having some large orders for special designs in mahogany. Their bronze push buttons are very popular, especially in lion's and tiger's heads. The dark bronze double and single pushes are neat goods and selling well. They are making the same pushes now in oxidised silver. They also report a good trade in bells of all kinds.

The Big Eickemeyer Dynamo.—J. H. Bunnell & Co., 106-110 Liberty street, have been exhibiting in their Liberty street window one of the latest Eickemeyer dynamos built by them. It is a big machine with a capacity of 50,000 watts, intended for storage battery work. Alongside of the machine stand the other various sizes, down to the smallest of 1 h. p. This new big machine weighs 6,500 lbs., and is run at 825 revolutions, giving 500 ampères at 100 volts, and taking 65 h. p. at its pulley. The machine is 39 inches high without bed-plate, two feet wide, and five feet ten inches from end to end of the armature shaft. The pulley is 13 inches face, and 18 inches diameter. The commutator is in 70 sections and the current is taken off by four brushes. There are 300 pounds of No. 21 B. & S. copper wire on the field and 40 pounds of No. 11 B. & S. on the armature. The resistance of the field is 1,400 ohms, and of the armature .5 ohm. There are 14,880 convolutions of wire in the fields and 245 in the armature. As an interesting comparison with this it may be worth while to mention that the little one horse machine giving 12 ampères at 55 volts weighs 210 pounds, is 15 inches high, 7 inches wide, 23 inches long and has a pulley of 3 inches face and 4 inches diameter, running at a speed of 1,800 revolutions. The Eickemeyer motors are made of any size from one-half h. p. up.

The Mercer Rubber Company.—I find the following interesting item in the New York *Times:* "The building of the new naval cruiser 'Baltimore' is likely to have an important effect upon the rubber industry. When the Navy Department received the plans for the vessel, for which Humphrey & Tenant, of England, were awarded a prize of $25,000, it was found that the requirements were for rubber valves in her machinery which should be capable of resisting heat up to 320 degrees. No American factory had ever made rubber that would endure such a test or anything like it. Instead of sending for the rubber to England, where it could easily have been obtained, the department encouraged the American manufacturers to improve their work. Experiments to that end have since been going on in several factories. Accompanying the plans for the 'Baltimore' were several maxims, as they are called, in which Humphrey & Tenant described in a way the manner in which the rubber should be made. In its composition, they said, there should not be more than 70 per cent. of white oxide of zinc nor more than 3 per cent. of sulphur. Working upon these data and their own general rules for rubber making, the Americans soon found themselves completely at sea. Sulphur mixed with rubber will vulcanize or harden it at a certain temperature, but at a higher temperature the composition becomes soft again. After many trials the manufacturers found they could make a rubber which would remain hard at a high temperature, but rapidly lost its flexibility—a quality just as necessary as resistance to heat. Chief Engineer Robert B. Hine, United States Navy, who has been examining and testing the samples from the manufacturers, announces that the problem has been solved. The contract for the 'Baltimore's' valves has been let to the Mercer Rubber Company, of Hamilton Square, near Trenton, N. J. While the work of this company, Engineer Hine said, was the best, several other firms had succeeded in turning out specimens nearly as good, and it was evident that this quality of rubber would be made in the United States hereafter instead of being imported. The company will also furnish the rubber valves for the war vessels 'Concord' and 'Bennington,' and will compete for contracts for similar work on the 'Maine' and the 'Texas.'"

The Tucker Electric Construction Company, 35 Broadway, will move on the 20th inst., to the new Paulding Building, Whitehall and Bridge streets, where they will occupy five rooms on the second floor, with a store-room in the basement. They have ten windows looking out on Whitehall street. The offices are commodious and well ventilated and all finished in light oak, with furniture to match, as well as handsomely decorated. They will all be fitted up in the most elaborate style with the latest improved apparatus. The desk of each officer and salesman and clerk will be connected with a central office by electric call, and a speaking tube system will connect the store-rooms and the salesmen's office with the general manager's office. Each room, and especially that of the officers, will be elaborately fitted up with electroliers and side brackets, to display in an appropriate manner the Mather system of incandescent lighting. The office in the northwest corner of the building will be occupied by Mr. C. A. Tucker, the president of the company, and will be equipped with every convenience for the reception of architects, contractors and the other patrons and guests of the company. This room will also be a board room. Mr. Sinclair will have a very comfortable sanctum, with special compartments for the filing of plans, specifications, etc., for handy reference. Another room will be fitted out with all the best well-known specialties of the company in working order, and all the windows and doors of the offices will be electrically connected to illustrate their method of protection. The company's electric fire door will also be shown in full operation. The object of this door is to have it connected electrically to a thermostat in the building, so that in case of fire the operation of the thermostat causes the door to close immediately and cut off the communication of the fire to the other sections of the structure. This is a practical and highly successful feature and is coming into general application for large storage houses, and for buildings of all classes. Special telephone conveniences will also be provided in these new quarters. Mr. J. W. Bean is the general manager of the company and will occupy one of the offices. Near him will be the assistant general superintendent, Mr. E. W. Seymour, who has control of the sales department. Mr. W. E. Gavit has

control of the purchasing department and supervises the work done. The company are now fitting up the new big Plaza Hotel Fifty-ninth street and Fifth avenue, which they are re-wiring throughout for telephone, telegraph, district messenger, annunciator, and alarm circuits, and especially for the incandescent system. They are also putting in an annunciator and return call system, a watchman's clock system, and the latest improved electrical apparatus in vogue. This is said to be the largest contract given out in this class of work during the present year. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, April 15, 1889.

The Bill Clutch Works are to equip the new stations at Bangor, Me., and Quincy, Mass., with power transmission machinery.

Postal Telegraph Company.—The receiver of the Bankers' and Merchants' Telegraph Company has got out writs of attachment against Postal Telegraph officers in Connecticut, and keepers have been put in charge. It is expected that the matter will be adjusted.

Laconia, N. H.—The Laconia Electric Lighting Company is running about 600 lights on the Edison 2-wire system, but is going over to the 3-wire system at once. It has an arc plant of three 15 Arnoux-Hochhausen machines, lamps of 2,000 c. p., and is running 25 street lights and 7 commercials, circuits 2¼ miles long of No. 6 B. W G. underwriter's wire and Callender. The company uses water-power, but has an engine in reserve. Mr. G. C. Sanborn is the superintendent.

The Peace Dale Company's Electric Light Plant.—The mill of the Peace Dale Company, in the town of South Kingstown, R.I., has been for some time lighted in part by electricity. The Edison system is used, and 320 lights of 105 volts, 16 candle power, are used in the weaving shed, dressing-room, designing-room and in the finishing department. The rest of the mill is lighted by gas. The dynamo is driven by belt from the main engine, a Corliss horizontal of 35 horse power. The lights are arranged in six circuits and are in charge of a self-instructed electrician. The company has recently installed an interesting addition to its lighting plant in the shape of two cells of the Electrical Accumulator Company's storage battery to run the C. & C motor attached to the phonograph and graphophone, which modern inventions the company has in use. The whole installation is running very smoothly and satisfactorily.

The New England Electric Exchange.—The annual meeting of the New England Electric Exchange was held at the rooms of the Boston Electric Club on April 8. There were present about 28 members, constit uting about one-third of the full roll. An address was delivered by President Alexander, who spoke of the length of time that the exchange had been in existence, the feeling of outsiders toward it, and the pleasant relations that prevailed between the electric fraternity and insurance interests. He stated that there had been for the year, 175 applications for licenses, 150 had been examined, and of these 44 were granted certificates. Sixty-eight obtained a lower grade and four a higher grade than examined for, and six were rejected as totally unfit for the business of an electrician. The treasurer's report was then read and accepted, and in the business meeting which followed it was voted to raise the annual dues from $3 to $5.

In addition to the regular business there was lively discussion of the "Insurance Requirements for Electric Lighting Stations," growing out of the fact that there had been considerable trouble of late in obtaining insurance on central stations. In regard to this matter the N. E. Insurance Exchange had prepared a plan showing how a model electric station should be built in order to obtain the lowest possible rates of insurance.

An excellent paper was read by M. J. Perry, of Providence, upon "Economical Steam Plants for Electric Lighting Stations," which embraced what constituted the true economical work of a central station. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., April 15, 1889.

Newark, Del.—At a recent election the citizens of Newark, Del., by a majority of 155, decided not to authorize a loan of $8,000 to purchase an electric light plant.

A Large Contract.—Bids for furnishing electroliers for the new Girard Life Insurance Company's building at Broad and Chestnut streets were opened by the directors last week and the contract was awarded to Messrs. Dekosenko and Hetherington, after a sharp discussion. About 400 electroliers and brackets will be placed in the building.

A Municipal Plant.—At the last meeting of Councils a motion was made to appoint a special committee, consisting of members from each chamber, to inquire into the advisability of establishing a city plant for arc and incandescent lighting. Considerable opposition was manifested, but the matter was finally carried and the committee appointed.

J. Elliott Shaw & Co., of 53 North Seventh street, this city, are successors to Shaw & Geary. They are bringing out a number of new specialties that will be of interest to the electrical trade, They handle the Shaw & Geary air compressors, blow pipe pumps, etc., and pay great attention to all kinds of electrical and mechanical work in the experimental line.

The Edison Company, of this city, have issued a circular, in which they announce that they are ready to give service from their Sansom street station in any part of the city included within the boundaries of Third to Twentieth and Market to Walnut streets, with the exception of on Market street from Broad, west. The station is now running day and night, including Sundays.

New Central Stations.—Agents of the various electric light companies in this city are contesting for several contracts for central stations. Some of them are: Media, Pa., 50 arc and 1,000 incandescent lights; Minersville, Pa., 30 arc and 600 incandescent lights, and Mauch Chunk, Pa., 30 arcs and 800 incandescent lights. South Chester, Pa., also wants a central station, but is undecided concerning what light to use. The Council is about equally divided on the different merits of the arc and incandescent methods,

What Is It?—During the argument heard in Harrisburg last week in the case where the different electric light companies want to receive the benefit of the law of 1885, which exempts manufacturing corporations from paying State tax, Attorney-General Kirkpatrick, of the State, who made the opening argument, advanced the proposition that the companies were liable to taxation because "the production of electricity was not manufacturing within any definition of the term given by known authorities."

Beauty and Brilliancy.—At the reception, given in honor of Postmaster-General Wanamaker by the Manufacturers' Club, in their new club-house in Walnut street, all the electric lights in the building were turned on, flooding the rooms with a wealth of illumination. Vines were gracefully entwined amid the electroliers, delicate hued flowers subdued the white glow of the incandescent lights and in every place where a combination of electric light and beautiful plants could be effected it was tastefully and harmoniously done. It was one of the features of the evening, and the many distinguished gentlemen present expressed their pleasure in highly complimentary terms. The Thackara Manufacturing Company had just completed putting in the fixtures, and this occasion tested their abilities in a very satisfactory manner.

Underground Wires.—The question of placing all telegraph, telephone and electric light wires underground was again agitated in City Councils last week. It was during an animated discussion on matters electrical that Mr. Kenton introduced a resolution which provided that the Director of Public Safety be requested and directed to notify the telephone, telegraph and electric light companies to remove all the poles and wires from the streets in the business sections of the city before Oct. 1, 1889. The brief limit of time in which to carry out the terms of the resolution was enough to kill it, as councilmen are beginning to understand that work of this magnitude cannot be accomplished in a day. But one of the strongest arguments against its adoption was the fact that the Bell Telephone Company was making decided headway getting its wires underground, and that some electric light companies were already working on underground service, and others were considering it.

Church Lighting.—The magnificent new edifice erected by the First Presbyterian Church of Wilkesbarre will be lighted throughout by electricity. It was first thought best to use gas, but the younger element of the church authorities demanded a compromise, with the result that combination fixtures are to be put in, the use of gas being reserved for the imaginary emergency. The main fixture will be a massive chandelier suspended in the centre of the church, being fitted with 80 gas burners and 80 incandescent lamps. The design is very strong and artistic. Its dimensions proper are 10 feet diameter at the base and 25 feet in height, presenting an imposing appearance. In the rear of the church will be suspended a hollow Greek cross of artistic design, in which will be put several 16 c. p. lamps. The effect is said to be very beautiful. On the walls will be attached 30 combination brackets. Messrs. Dekosenko and Hetherington designed and made the fixtures.

Messrs. James Queen & Co. have recently completed extensive improvements in their store, No. 924 Chestnut street, and now have unexceptional facilities for exhibiting and handling their stock. In their display of philosophical and electrical instruments, of which they have a large and complete line, they show some new instruments from foreign makers that are particularly attractive. An interesting exhibit is a large working model of Ayrton & Perry's new hot wire voltmeter, which was recently illustrated in THE ELECTRICAL WORLD, and which is selling well. In addition, there is shown a model illustration of the action of Ayrton & Perry's ribbon spring as applied to spring balances; a case with samples of these springs containing those made for the spring ammeter and voltmeters and for barometers, thermometers and hot-wire voltmeters, the last being so fine that the convolutions can hardly be seen. The testing instruments made by Queen & Co. from designs made by Prof. W. A. Anthony and tested by him, are meeting with favor and supersede the Elliott instrument. They are also working on improvements of a photometer for testing arc and incandescent lamps. All the expert and experimental work of this concern is under the direct supervision of Mr. Richard O. Heinrich, whose ability and experience in this field is well known. E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, APRIL 8, 1889.

The Berriman Heater Company, through the agency of Mr. W. H. Gibson, has sold to the Cincinnati electric generating station belonging to the street railway of that city a heater for a 500 h. p. boiler.

The Williams Engine, which is handled by Fairbanks, Morse & Co., of Chicago, has been awarded the contract for the St. Joseph, Mo., lighting station. This firm are making a specialty of engines for electrical work.

A Lecture on Electricity was given Friday, April 12, in Omaha, Neb., by Harry A. Kinney, a local expert. The subject was "Electricity, its source, characteristics and appliances." The lecture was good and was well received.

Chas. D. Shain, of the Westinghouse Electric Company, has been appointed general district agent for the States of Ohio, Kentucky, West Virginia and the peninsula of Ontario, Can. Mr. Shain will be stationed at Cincinnati.

The Chicago Electric Service Company are a company controlling the Johnson patents for the automatic regulation of temperature and electro-pneumatic specialties. They are fitting the "Rookery" building with their heat regulator system.

Niagara Again.—Mr. D. N. Long, an engineer, has a scheme for draining the City of Buffalo, N. Y., and deriving sufficient power from Niagara Falls to light the city by electricity and furnish power for eighteen miles. About fifteen miles will be a surface ditch and three miles a tunnel. The tunnel portion will be at the Falls. The Buffalo and Niagara Water Power and Drainage Company has been organized to carry the scheme into effect, with a capital stock of $5,000,000. It is planned to have all the trunk sewers in Buffalo empty into the channel.

The Improved Lowth Stetho-Telephone.—A modified form of the Lowth stetho telephone, described in last week's ELECTRICAL WORLD, has been made. The size and weight have been reduced. It weighs only eight ounces, and from the centre of the receiver to the button is exactly 4½ inches. This style will be exclusively used now. It is only necessary that the button should be held in the vicinity, the instrument will transmit by being held against the breast, back of the neck or top of the head, in fact wherever there is muscular vibration of the human body during the act of speaking.

Memphis, Tenn.—Speaking of the fine new Fransioli Hotel, the Memphis *Appeal* says: "The office is equipped with one of the most complete annunciators made. Every room and floor is thus connected with the office. The electrical work was done by Capt. J. D. Randall, of the Novelty Electric Company. An attachment of Captain Randall's own invention consists of three electric buttons placed beneath the annunciator by which the bells on one floor or on all the floors can be rung simultaneously in case of fire. The rooms are also provided with a simple but very ingenious invention of Captain Randall's, by which a person lying in bed or sitting at a table can ring for assistance without rising. This invention is certain to come into general use as soon as its merits become known." Chandeliers have been put in for electric lighting.

The Chicago Electric Club.—A renewed enthusiasm has been awakened at the Chicago Electric Club. The words, "We are going to move," seem to have been a perfect talisman to give it a new lease of life. The new quarters will be a great improvement upon the old. These latter were the greatest argument against the club. In a cheap locality and in rooms too small for it, there was great difficulty in keeping up the interest of the members. At last it has been decided to move. The new quarters have been chosen. They are on Adams street, just beyond Kinsley's, who will do the catering. This change has always been advocated by Mr. S. A. Barton, the president of the club. Mr. Barton, and many other gentlemen, unaccustomed to such mean surroundings, were, from the first, urging a change. The first time Mr. Barton took the chair he suggested that a change be made, and gave the impression that he would be responsible for a goodly share of the increased expenses. The suggestion, unfortunately for the club, was allowed to pass unheeded. Now it is painfully evident that the change must be made to retain the members. This is proven in the fact that more enthusiasm than has been evident for a long time was noticeable at the last two meetings, when the subject of the change was discussed. The new quarters are going to cost more, but the extra cost has been thoroughly canvassed. Two whole floors are to be used instead of one, as formerly. Another subject that is largely interesting members is the election. A nominating committee, consisting of Mr. George Cutter, Mr. Fred. De Land and Mr. F. S. Terry, have been chosen, with instructions to report upon the 15th of the month. It is more than probable, from a thorough canvass of the electrical trade in this city, that if Mr. Barton be renominated his election is certain. Mr. H. Ward Leonard has also been mentioned for the place of honor. W. A. N.

CHICAGO, April 13, 1889.

A Good Sized Belt has been put in by the Peoria Electric Light Company, of Peoria, Ill. This belt is of the linked leather style, 10 inches wide and 44 feet long.

The South Dallas, Tex., Improvement Company is arranging to erect an electric light tower with six lights upon it. This will light the business part of South Dallas.

An Electric Railway for Allegheny.—The Pleasant Valley Street Car Company has decided to put in an electric plant. Work will be commenced at once and it is expected that the line will be running by fall.

Electric Light for Walsenburg, Col., is assured by the signing of the contract with the Edison Electric Light and Power Company, of Denver, to put a plant into Walsenburg. It will be completed about July 1.

Mr. George Cutter has secured headquarters at 80 Adams street, where he will occupy the whole second floor. He has accepted the agency of the Simplex Wire Company. He has already taken an order for 5,000 pounds of this wire.

The Marshalltown Electric Company, of Iowa, was incorporated recently. The object of the company is to equip, construct and operate an electric plant for the purpose of producing and furnishing electricity for light, heat and power. The capitalization is $30,000.

Storage Batteries in New Orleans.—An electric motor street railway car, on the storage battery plan, has just arrived at New Orleans, and will be put in operation on the St. Charles & Colosseum route. The success of this car will determine whether or not the line will be successful. It is a Daft car with Gibson cells.

A Plant for Rushville, Ind.—The City Council of Rushville, Ind., has contracted with the Edison Electric Light Company for a plant. This plant is to be operated and owned by the city at a cost of $9,400. There will be 140 thirty-two and fifty c. p. lamps. The plant will be in operation within sixty days.

Chicago Electric Club.—The following ticket received the unanimous vote of the nominating committee: President, S. A. Barton; vice-presidents, H. Ward Leonard, F. B. Badt, Alex. Kempt, D. P. Perry; secretary, W. A. Kreidler; treasurer, F. S. Terry; managers, B. E. Sunny, F. E. Degenhardt, M. A. Knapp, E. Baggot, H. A. Glasier, Wm. Zimmerman, M. M. Lenhart, Geo. B. Bailey, J. H. Shay, E. A. Sperry; membership, C. C. Haskins, F. De Land, Geo. W. Whitefield, F. W. Parker, C. K. Giles.

Left in Punitive Darkness.—A dispatch from Colorado states that the Colorado Electric Light Company, of Denver, is holding to its determination to cut off the service of those who persist in wasting the light. There are two firms of that city that for the last few nights have been in darkness, and it is rumored that there are several others who are liable to be caught the same way. Charles H. Smith, the president of the company, states that it has been figured that the actual collections, according to the contracts are $10,000 less than the cost of the light used. Meters are being put in as fast as possible.

Recent Corporations.—The American Electric Meter Company, of Chicago, has been incorporated with a capital of $200,000 to manufacture electric meters, materials and merchandise. The incorporators are John Marder, E. S. Skinner and R. E. Richardson. Another is the Green Bay and Fort Howard Electric Railway and Power Company, of Chicago. This company has a capital stock of $100,000. They propose to build and operate street and dummy railways in Brown County, Wis., supply electric light, heat and power in the cities of Green Bay, Fort Howard and other places; incorporators, H. Ward Leonard, E. M. Izard and M. L. Coffeen.

And Still Another Telephone.—Among the recent incorporated companies of the Illinois Legislature is the United States Vogel-Kazophone-and-Electrical-Microphone-Trumpet-Acoustic-Electromotor-Power-Musical-Car-Distance-Loud-Speaking-Transfer-Instrument Company, Chicago; capital, $65,000,000; to manufacture instruments, rent rights and privileges; incorporators, William Vogel, Adolph Gray, Richard H. Dakin.

This device is not so complicated as its name would signify, and in fact the name is expected to be contracted soon into "Vogelgraphone." It is simply a repetition of the oft-tried experiment to make a louder sound by using a larger diaphragm. Mr. Wm. Vogel, the inventor, is at Lake View, where the drawings of the instruments may be seen. His claims for his invention are simply enormous. In his own words the claims set forth are that "the sound of the voice can be transmitted thousands of miles and still be plainly heard in any part of a medium sized room." In proof of this statement Mr. Vogel says that he has tested it with *one mile of wire* and that it worked to a charm. W. A. N.

MILWAUKEE, Wis., April 7, 1889.

Eau Claire, Wis.—An accident at the water power station on April 6 may result in the death of Mr. A. Foreman, superintendent of the Brush Electric Company. Mr. Foreman was in the company's building, the upper door of which is fifty feet above the ground. An excavation being in progress, the plank bridge from the door to a high embankment opposite had been removed. Mr. Foreman rushed

to the door to see the result of an explosion of a blast in the excavation, lost his balance, and fell fifty feet, striking his hip on a jagged edge, and falling on his head in the pit below. His skull is fractured and other serious injuries were sustained.

Wauwatosa, Wis.—The building of the electric light service is nearing completion. It is absolutely fire-proof, the walls being built solidly of brick, the roof being iron and floors tiling. The engine and two dynamos will probably be put in this coming week—two more dynamos will be added next fall. It is expected that by May 1 all will be in running order, and Wauwatosa people will no longer have to carry lanterns. The company has an incorporated capital of $50,000. There are over 75,500 feet of pole line, upon which is stretched something like fifteen miles of wire, and 1,000 lights will be in use at starting. The officers of the company are: E. R. Godfrey, president; E. D. Holt, vice-president; Edward Coulthard, secretary; Chas. Stickney, treasurer, and Frank H. Godfrey, superintendent.

THE TELEGRAPH.

Palestine, Tex., is to put in an electric fire alarm system.

Wellsville, O., will put in an electric fire alarm system. Mr. C. R. Van Fosson is chief of the department.

Baltimore, Md.—The Southern Electric Company has secured a contract for $6,275 for new patrol electric service to be put in.

Olean, N. Y.—Mr. W. H. Simpson, of the fire department, informs *Fire and Water* that an electric fire alarm system is required.

The National Telegraphic Press Association, Chicago, capital $10,000, to furnish daily telegraphic reports and general correspondence, has been incorporated by Anthony P. Morris, Chester H. N. Brisco and John Moffitt.

The Brooks Underground System.—A circular has been issued by the Brooks Underground Telegraph Construction Company, of Philadelphia, giving the expense of laying the Brooks system, as compared with that of others. It is an interesting study.

The Atlantic Postal Telegraph Company has been incorporated in this State with the following directors: Richard V. Dey, Andrew Wesley Kent, James N. Jameson, John M. Platt and Hiram Smith. The capital stock of the company is $50,000, divided into 500 shares of $100 each.

Wires to Come Down.—The Board of Electrical Control have sent a letter to the Police Commissioners directing that all the Police Department wires strung on the poles of the Western Union Telegraph and Metropolitan Telephone companies on the line of Sixth avenue, from Bleecker to Fortieth street, be removed at once so that the poles could be removed. The Superintendent of the Police Telegraph was ordered to remove the wires as soon as possible.

THE TELEPHONE.

Supplies for the Life-Saving Service.—It will be seen from our advertising columns that Mr. S. I. Kimball, general superintendent of the U. S. Life-Saving Service, is asking for bids on a large quantity of telephone supplies to be used at various points on the Long Island coast.

Mexican Telephone.—At the meeting of the directors of the Mexican Telephone Company last week, the following officers were elected: Robert Colgate, New York, president; Harmon Hall, vice-president; W. F. Smith, Boston, treasurer; W. H. Harrington, Boston, secretary. Transfer books were closed until and including April 23.

THE ELECTRIC LIGHT.

Atalla, Ala., proposes to put in a plant.

McKinney, Tex., is to have an electric light plant.

Walsenburg, Col., is planning for an electric light plant.

Rensselaer, Ind.—An electric light plant is being put in.

Leesburg, Va.—Mr. Earson will put in an electric light plant.

Russellville, Ky.—It is proposed to put in an electric light plant.

Oxford, O., has issued $20,000 of bonds for an electric light plant, etc.

Princeton, N. J., will probably put in an electric light plant this summer.

Belton, S. C.—Rice Bros. propose to put an electric light plant in their grist mill.

Portland, Ore.—The recent electric light ordinance has been vetoed by Mayor Delashund.

Selma, Ala.—Mr. R. M. Nelson and others have made proposals to put in a Westinghouse plant.

Tarboro, N. C., is to vote this month on issuing bonds for $5,000 to pay for a city electric light plant.

Roanoke, Va.—The Roanoke Electric Light and Power Company are now putting in their Edison plant.

Anderson, S. C.—Mr. Trible, mayor of the city, is receiving bids for a city plant of 1,000 incandescent lights,

Lyons, Kan.—The Lyons Electric Light Company is considering the matter of putting in some storage batteries.

Stanford, Ky.—Mr. W. N. Potts will probably put an electric light equipment in his mill and supply lights to the town.

Fernandina, Fla.—The Fernandina Light and Power Company have contracted with Mr. O. S. Oakes to build their new station.

The New York Atmospheric Conduit Electric Light and Power Company have filed articles of incorporation in the State of West Virginia.

Summerville, S. C.—Mr. G. B. Edwards is pushing plans for an electric light and power plant and for an electric road. The Thomson-Houston system will be used.

Texarkana, Ark.—The Texarkana Gas and Electric Light Company will run their dynamos with gas engines. They also want information as to the cost of an electric road.

The Manhattan Electric Light Company, of New York, has informed the Mayor that it has put 53,900 feet of cable into the subways and has removed some of its overhead wires.

Williamstown, Mass.—The Williamstown Electric Light Company has applied for permission to do a gas lighting business, but will equip first for electrical service, running its plant by water-power.

Danville, Ky.—A company with a capital stock of $5,000 has now been formed by G. A. Curry, H. C. Bohon, R. C. Nuckols and others, which will furnish the city with 60 arcs and do a general business.

Harrodsburg, Ky.—The Harrodsburg Electric Light and Power Company, through Mr. L. D. Caldwell, is in the market for a plant of 600 incandescent lights, with steam plant to match, 5 miles of wire, poles, etc.

Washington, Kan.—There is some talk of the city buying the electric light plant. It can be had for $4,000, and the owners claim that it can be run so that the city will get its street lamps for less money than at present.

Jonesboro, Ark.—B. Dilton and others, have incorporated as the Jonesboro Electric Light, Heat and Power Company with Marcus Berger, president; J. B. Dillon, Jos. Dixon and J. W. Perkins directors. The capital stock is $10,000.

Owensboro, Ky.—Mr. W. E. Groff, of the Queens City Electric Company, of Cincinnati, is putting in a 25-light plant for the Owensboro Ice Company. Mr. Groff will also put in shortly a 200-light plant in the Barrett House, Henderson, Ky.

The Frenchmen's Bay Land and Water Company, Maine, are arranging with the Consolidated Electric Association to have the cottages, streets and avenues at the growing summer resort of Sorrento illuminated by electricity.

Anniston, Ala.—The Thomson-Houston Electric Company reported as contracting to light the city and to erect a plant have bought the plant of the Anniston City Land Company and will erect a new plant at a cost of about $40,000.—*Mfrs. Record.*

Newton, Mass.—The Newton Electric Light Company is putting in several large dynamos for furnishing power to the Thomson-Houston Company to operate the electric road between Waltham and Newton.

New Birmingham, Tex.—The New Birmingham Electric Light, Power & Street Railway Company has been formed by M. D. Mather, D. R. B. Wickes and W. J. Needles, with a capital stock of $50,000. The company will build an electric road. Mr. Mather has recently put in a Westinghouse lighting plant.

Canton, Mass.—The Neponset Electric Company have petitioned the selectmen for the privilege of erecting poles and building an electric plant to cost $40,000, for the purpose of supplying arc and incandescent lights, using the Thomson-Houston system. The company proposes to extend the system to include Walpole and Norwood.

Rochester, N. Y.—The following proposals for putting in an electric lighting plant for the county buildings were opened March 29: Brush Electric Company, $6,450; United States Electric Lighting Company, $6,700; Thomson-Houston Electric Company, $4,845; Edison Electric Light Company, $5,800; Atkinson & Sykes, $5,175; Western Electric Company, $5,800.

Concord, N. H.—The Gas Light Company, of Concord, N. H., have just taken possession of the electric lighting plant recently purchased by them from Messrs. A. S. Hammond and N. P. Stevens. The price paid was $30,000. Mr. Stevens has been appointed superintendent of the electric department, and William Badger continues as superintendent of the gas light department.

Waterhouse Arc Lighting Installations, as follows, by the Westinghouse Electric Company, are reported: Central Stations: Huntington, W. Va., E. L. & Street Railway Company, 70 lights; Ashland, Oregon, 35 lights; Corning (Ia.) Electric Company, 35 lights. Isolated Plants: Sacramento, Cal., Southern Pacific Railroad Shops, 40 lights; Cosmopolis (Wash. Ter.), Gray's Harbor Mill Company, 35 lights.

St. Louis, Mo.—The St. Louis Thomson-Houston Electric Light Company has filed with the Secretary of State affidavit of increase of capital stock from $150,000 to $500,000; also, affidavit of change of name to "The United Electric Light Company," and increase of the number of directors from five to seven. The new company is the result of the consolidation of all the electric light companies in the city of St. Louis.

Brooklyn, N. Y.—The Brooklyn Electric Light & Power Company have applied to the Common Council for permission to erect poles and string wires for arc and incandescent lighting. The company agree to have 300 lights ready within twenty-four hours after consent was granted, and to have 2,000 feet of underground wires laid within sixty days. The aldermen discovered a clerical error in the communication and ordered its return for correction.

Ball Electric Light Company.—At a meeting of the stockholders of the Ball Electric Light Company, held at the offices of the company, 18 Cortlandt street, on April 9, 1889, the following trustees were elected: Sherman W. Knevals, Thomas S. Acheson, W. W. Flannagan, Charles E. Ball, Robert Dunlap, Sol Sayles, John C. Noyes, James H. Breslin, William L. Brown, George W. Cotterill, William S. Hopkins. The officers of the company will be elected during the present week. The statement of the business of the company during the last year was entirely satisfactory to the stockholders present, and they report an unusually heavy spring business.

The Standard Underground Cables in use for the underground arc circuit of the United States Illuminating Company in this city are reported to be doing well. The cables extend from Broadway and Thirty-fourth street down to Twenty-third street, thence to Sixth avenue, and up Sixth to Thirty fourth street. There are three cables on this route, all ending on the United States pole, southeast corner of Thirtieth street and Broadway. One of the cables is in this circuit, and the other two are being connected on to other circuits. All these have been tested and approved by the Board of Electrical Control, and 45,000 feet more of Standard cables have been ordered, additional to the 36,000 laid and tested.

APPLICATIONS OF POWER.

Dover, N. H.—The Dover Clothing Company, of Dover, runs all its sewing machines by electricity.

Denver, Col.—Collins & Shackleford are interested in the new electric road, to be built to University Park.

Wichita, Kan.—The Riverside and Suburban Electric Railway Company are adding three more cars to their rolling stock.

Norton, Kan., is to have an electric road this year. A new electric light company is to be organized, which may supply it with current for operating by electricity.

Newark, O.—The Newark and Greenville Electric Street Railway Company have begun work again on their road, and hope to have the entire line running within sixty days.

Macon, Ga.—Mr. J. B. Colgrove, of New York, and others have bought the Macon Dummy Railroad and will probably operate it by electricity, when they will spend $50,000 on the plant.

Austin, Tex.—Mr. T. J. Hurley, of Fort Worth, and others have bought the Austin Street Railroad for $120,000. They will spend about $200,000 in extending it about five miles, and in equipping to operate by electricity.

Richmond, Ind.—Mr. J. C. Shaffer has contracted with the Thomson-Houston Company to equip his new street railway at Richmond, Ind., and expects to be ready to operate by the first of June. Russell & Co., of Massillon, O., will put in the steam plant, Pullman cars will be used with the overhead system of wiring, for which the material is now on the spot.

Buffalo, N. Y.—The Buffalo Street Railway Company have made a contract with the Sprague Company for the equipment of their road by electricity, the contract being secured by the company's Buffalo agent, Mr. E. E. Higgins. The Buffalo company carries 11,000,000 passengers a year, and the contract is the result of a careful investigation by President Watson and the directors. The work of equipping for electricity will be done gradually, and the whole line will be remodelled when the necessary franchises and consents have been obtained.

Chattanooga, Tenn.—A fine Sprague road is being put in at Chattanooga. The contractors are Woodbridge & Turner, the well-known electrical engineers of New York City. The company will use the overhead system throughout and will build 20 miles of track. Six cars have been ordered to start with, being 18 foot cars. The average speed is to be 15 miles an hour. The contractors say: "The work is now being rapidly pushed to completion, and we hope in a few days to have the cars in operation. It is to be the finest road in the South, or anywhere, for that matter."

PERSONALS.

Mr. Henry C. Davis.—The many friends of Mr. Henry C. Davis will be pleased to learn that he has returned home after a long sojourn abroad.

Mr. C. V. Boisot, of Buenos Ayres, South America, has just left this city for home. He is putting in a 30,000 light Edison station, etc., at Buenos Ayres, and the plant is now being shipped as rapidly as possible. The Edison system enjoys great popularity in the Argentine Republic, where a large number of isolated plants are now in existence, and already there is the fullest assurance of the success of this fine station, plans for which were furnished by General Superintendent, J. H. Vail. Mr. Boisot, it may be mentioned, is an old telegrapher, well-known on the Pacific slope.

MISCELLANEOUS NOTES.

The American Electric Meter Company has been incorporated at Chicago, by J. Marder, E. S. Skinner and R. E. Richardson, with a capital stock of $200,000.

Sacramento, Cal.—The Central Street Railway Company of Sacramento have adopted the Crowdus combined electric farebox and register after having tried its operation.

Okonite.—We learn that Okonite wire is specified for all the wiring for electric bells and messenger calls in the Auditorium Building, Chicago. Over 200,000 feet will be required.

The Keelyn Electric Company.—Articles have been filed at Milwaukee, Wis., incorporating the Keelyn Electric Company of Milwaukee, capital $1,000. Incorporators, James Keelyn, Edward Fitch and W. D. Van Dyke.

Information for Wiremen.—We have received a letter from "A Wireman" urging all interested in practical wiring to unite for the study of electricity. We shall be glad to promote such a movement. At the same time, those who desire self-culture of this kind can do much by mastering the books on the subject, and by joining the New York Electrical Society.

The Electrical Accumulator Company.—President D. H. Bates informs us that in the United States Circuit Court, on April 9, Judge Coxe approved of the disclaimer filed by the Electrical Accumulator Company, and formulated the decree and injunction restraining the Julien Electric Company, their officers, agents and workmen from further manufacture, use or sale of secondary batteries of the Faure type, in which the active material is applied to the support in the form of a paint, paste or cement. Notice of the injunction has been served on the Julien Company and the Fourth Avenue Railway Company, this city.

St. John, N. B.—The St. John Board of Trade have issued notice to the effect that arrangements have been made for holding an electrical exhibition in that city, beginning on the first of July and continuing for ten days or more. It is to be held in connection with a carnival celebrating the union of the cities of St. John and Portland, as well as the opening up of the connection with the Canadian Pacific Railway. Space and power will be furnished free of charge to exhibitors, and exhibits from the United States will be admitted in bond to save the payment of duties. An extensive general exhibition will be held in the same building about three months later, and arrangements can be made to have the electrical plant remain for that if exhibitors so desire. It is believed that the attendance at the electrical exhibition will be very large, and it seems a good opportunity for the American manufacturers to reach a large section of the Canadian public. All additional information will be furnished on application to Ira Cornwall, Board of Trade Rooms, St. John, N. B.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, No. 3 South Warren street, Syracuse, N. Y.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

Lodge, Davis & Co., Chicago, manufacturers of engine lathes, planers, shapers, Mr. D. Goodwin, manager, report trade excellent, they being in receipt of some large orders for lathes, drill presses, etc. He states that he has recently furnished complete outfits for several electrical works. The factory not long since made two shipments of tools to Stockholm, Sweden. The firm have in course of construction a new planer, and also an improved milling machine.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 9, 1889.

400,890. Regulation of Electric Motors; Forée Bain, of Chicago, Ill., Assignor, by mesne assignments, to the Electric Cutting Machine Company, of same place. Application filed April 6, 1888. A cloth cutting machine driven by an electric motor, and arrangement for regulating the speed of the cutting blades.

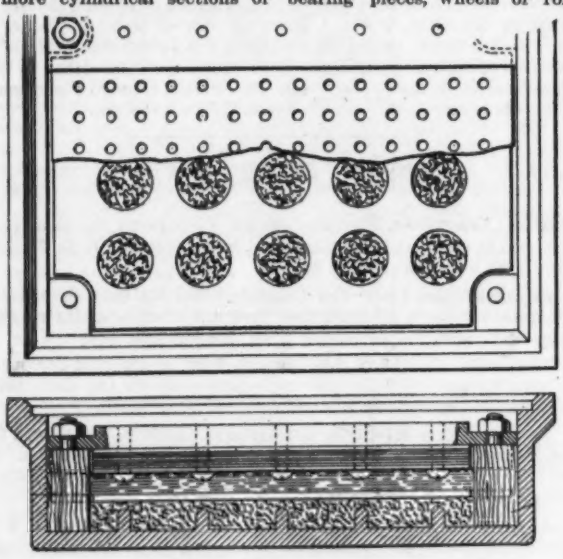
400,911. Telephone Support; Philo E. Hall, of Detroit, Mich. Application filed Nov. 25, 1887. The support of the transmitter is made adjustable up and down, so as to be instantly suited to the proper height for any individual.

400,916. Current Collecting Device for Electric Railways; Rudolph M. Hunter, of Philadelphia, Pa. Application filed Dec. 13, 1888. The combination of a flexible suspended conductor of circular cross-section, supports therefor at intervals in its length, a traveling vehicle, a grooved collector-wheel located below said conductor, and in the groove of which the conductor is received and guided against lateral displacement, and a support for said grooved collector wheel hinged to the vehicle on a transverse axis.

400,926. Electric Railway; Robert Lundell, of New York, N. Y. Application filed Dec. 12, 1888. In an electric railway the combination, with the line conductor and its insulating casing, of a circuit-closing plunger movable up and down and arranged, when pressed down, to make circuit connections with the line conductor, a plunger-shell fixed to said casing and having a neck through which the plunger projects upwardly, and a thimble fixed on said plunger and having an annular flange extending downward and embracing the top of said neck.

400,951. Electric Circuit Testing Device; Miner Robinson, of Newton, Mass. Application filed June 11, 1888. The device consists, generally, of a base carrying a centre post to which one side of a grounded battery is connected. This post is also adapted to be connected with all of a series of contacts arranged around it, the contacts constituting the terminals of the wires, from the different burners in the system. The normal condition of the circuits is closed through the contacts and the centre post and open at the burners. If, by accident or otherwise, the electrodes at a burner stick together, and thus complete that circuit an alarm is rung, notifying the attendant of the fact, and he may immediately break all the circuits at the board by severing connection between the centre post and the contacts. This stops consumption of the battery. Then by passing a brush or electrode having a connection with the centre post around the board, touching each of the contacts in succession, the faulty circuit may be detected by the formation of a spark when the brush passes over its contact-terminal; or, if there is not a complete circuit in the system, but simply a simply a leak, the same may be found by noticing the movements of a galvanometer placed in the brush-circuit when the brush is passed over the contact. See illustration.

400,958. Leading-In Apparatus for Conduits; John A. Seely, of Brooklyn, N. Y. Application filed Feb. 2, 1889. In a leading-in apparatus for conduits, the combination of two or more cylindrical sections or bearing pieces, wheels or rolls



401,291. PROCESS OF PREPARING ELECTRODES FOR SECONDARY BATTERIES.

pivoted on the line of their major axis, and a flexible connection uniting successive or adjacent sections.

400,969. Spring Jack Switch; Harry B. Thayer, of New York, N. Y., Assignor to the Western Electric Company, of Chicago, Ill. Application filed Jan. 31, 1887. The invention consists in building up the springs or contact-pieces of the switches in banks or layers with rubber strips interposed between the different layers, so that the different contact-pieces of each switch will be properly insulated and at the same time brought within as small an area as possible.

400,971. Alternating Current Electric Motor; Elihu Thomson, of Lynn, Mass. Application filed July 30, 1888. The invention consists in the peculiar construction of a motor in which the reaction between an alternating-current field and the currents, electric or magnetic induced thereby in a closed circuit armature, are employed to impart movement to either or both elements.

400,972. Induction Coil and Self-Inductive Apparatus; Elihu Thomson, of Lynn, Mass. Application filed Oct. 15, 1888. The invention consists in closing a gap or notch left in the laminated core for application of the coils by means of a magnetic laminated plug or stopper having a width or diameter in the direction of the magnetic axis that is substantially the width of the gap or notch and forced or driven tightly into the notch or gap, so as to completely close the magnetic circuit, such plug or stopper having its laminations parallel to the laminations of the main body of the core.

400,978. Electric Heating Apparatus; Henry F. Watts, of Sandusky, O. Application filed Nov. 22, 1888. The invention consists of an electric coil or coils surrounding a magnetic core or cores and metallic plates placed in inductive relation with said core or cores. When alternating currents flow in the coils, the metallic plates, by reason of the induced alternating currents generated therein, are raised rapidly to a high degree of temperature. This is utilized in a manner best suited to the purpose for which it is required. See illustration.

400,980. Standard Tangent-Galvanometer; Edward Weston, of Newark, N. J. Application filed May 3, 1888. For description see page 230 this issue.

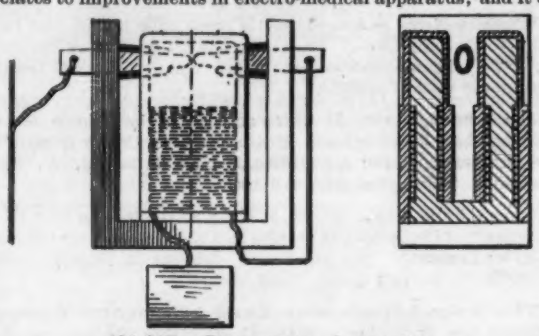
400,985. Telegraph Apparatus for Ships; James Bonelle Willis, of Portsmouth, County of Hants, England. Application filed Feb. 7, 1888. Patented in England, Jan. 18, 1887; in France, Dec. 7, 1887; in Belgium, Dec. 8, 1887; in Germany, Dec. 21, 1887; in Italy, Dec. 31, 1887; in Norway, Feb. 6, 1888; in Austria-Hungary, March 29, 1888; in Spain, May 23, 1888; and in Portugal, June 6, 1888. This invention has for its object improvements in electric telegraph apparatus suitable for use to communicate between the bridge and the engine room of a steamship. The transmitting instrument is provided with a handle movable around a stud, which, by preference, is horizontal. This handle is intended to be placed in positions corresponding to the signals to be transmitted, such as "stop," "slow," "half-speed," and "full-speed," both ahead and astern.

400,988. Ore Crusher and Metal Separator; Jacob Charles Wiswell, of Medford, Mass., Assignor to the Wiswell Electric Mining Machinery Company, of Portland, Me. Application filed Sept. 30, 1887. Electrified plates are used in connection with a crushing apparatus for the purpose of separating the particles of ore.

401,006. Electric Self-Winding Time-Piece; Manuel Carranza, of Guatemala, Guatemala, and Jose M. Tinoco, of San Francisco, Cal. Application filed Oct. 11, 1888. Consists in an electric motor connected with and adapted to drive the winding arbor of the time-piece to wind up its spring, an electric circuit including the motor, and a novel mechanism actuated by the time piece for closing and opening the electric circuit.

401,035. Electrical Night Signaling Apparatus; Emil Kaselowsky, of Berlin, Germany, Assignor to the Berliner Maschinenbau-Aktien-Gesellschaft, vormals L. Schwartzkopff, of same place. Application filed Aug. 7, 1888. The invention relates to a system of signaling by night, at sea, by means of differently colored electric lamps which are brought to view singly or in groups; and its object is to provide means whereby the electric current may be switched to and from the signal lamps and a supplementary resistance to produce the required signals.

401,041. Electro-Medical Apparatus; John J. Lewis, of San Francisco, Cal. Application filed May 28, 1887. The invention relates to improvements in electro-medical apparatus; and it con-



401,085. LIGHTNING ARRESTER.

sists especially in a novel construction of a primary-coil, a contact breaker with its adjustment, and the regulator, together with one or more electrodes, which may be applied in various ways.

401,059. Galvanic Battery; James H. Phalen, of New Haven, Assignor to the Electrical Supply Company, of Ansonia, Conn. Application filed Dec. 7, 1888. In a battery, the combination of a jar-cover with contractible element-securing devices and means whereby such devices are both contracted to secure the elements to the cover.

401,065. Electric Winding for Torsion Pendulum Clocks; Heinrich Rabe, of Hanau, Germany, Assignor to the Hanauer Elektrische Uhren Fabrik, Steinhauer Rabe, of same place. Application filed Aug. 31, 1887. When the actuating weight has reached the limit of its descent, a lever is thrown in contact with an arm secured to the pivoted armature, thus completing the electrical circuit, so that the magnetic coils are energized and the armature attracted and caused to swing, thus carrying the lever back to its original or starting position and raising the weight until the circuit is broken, when the armature returns to its normal position of rest, and the weight is left free to begin its downward movement again.

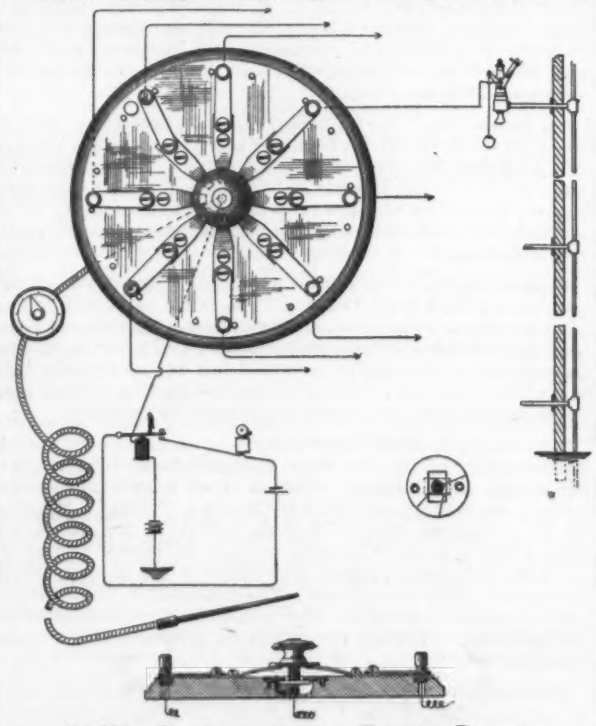
401,067. Circuit Connecting Device; John C. Reilly, of Brooklyn, N. Y. Application filed Feb. 13, 1889. The invention consists in the combination of a stationary plate of suitable form having the unconnected terminals of the cable wires and a corresponding connecting-plate adapted to be brought into contact with the stationery plate and having registering contacts thereon, which can be paired together in any desired manner.

401,085. Lightning Arresters; Elihu Thomson, of Lynn, Mass. Application filed Oct. 8, 1888. In an arc-rupturing device a shield of insulating material located between the surfaces of the electrodes and adjacent conducting-surfaces of the device by which the arc is disrupted.

401,095. Lightning Conductor for Wire Fences; Fremont E. Wood, of Yucca, Ariz. Application filed Nov. 28, 1888. In a lightning conductor for wire fences the combination of a sectional conductor and clamping sockets formed of two sections, each section being provided with a longitudinal groove and an aperture at right angles to the groove.

401,120. Manufacture of Incandescent-Lamp Filaments; Turner D. Bottome, of Newark, N. J., Assignor to John B. Tibbits, of Hoosick, N. Y. Application filed Sept. 29, 1887. The process of manufacturing filaments, consisting in saturating a carbon filament with a tungsten compound and reducing such compound to metallic tungsten.

(1) 401,152. (2) 401,153. (1) Armature for Electro-Magnets. (2) Electric Gas Lighting Burner; John Geary, of Philadelphia, Pa., Assignor to J. Elliott Shaw, of same



400,951. ELECTRIC CIRCUIT TESTING DEVICE.

place. Applications filed (1) Dec. 20, 1888; (2) Feb. 5, 1889. (1) In an armature for electro-magnets, the combination of one or more light sections and a heavy section held in operative relation by a hinge or other device in such manner that portions of each section will be opposite the surface of attraction of the poles of a single magnet, said light sections being influenced before the heavier section, traveling in advance of and drawing the said heavier section into the field of attraction. (2) In an electric gas lighting burner, the combination, with the magnets thereof, of an armature having pivoted thereon two cam-levers riding on shoulders and operating to impart rotary motion to the gas-cock.

(1) 401,154. (2) 401,155. (1) Tube or Conduit; (2) Conduit for Electrical Conductors; George H. Gillette and King C. Gillette, of New York, N. Y. Applications filed Jan. 17, 1887. (1) A tube or casing for a conduit, consisting of a series of sections formed of compressed wooden strips having grooved or slitted ends, suitable retaining bands and connecting sleeves, said section being disposed end to end and the said sleeves extended into the adjoining slits or grooves of the several connecting sections. (2) A conduit comprising a series of sections of non-conducting material, as glass, provided with contracting longitudinal openings, said sections being arranged and secured one after another with the corresponding openings in line, whereby one or more continuous ducts with bearings at intervals are formed.

401,156. Static Induction Machine; Hermann Glaeser, of Vienna, Austria-Hungary. Application filed Dec. 28, 1887. Patented in England, Aug. 29, 1887; in Austria-Hungary, Jan. 15, 1888, and in Belgium, Aug. 14, 1888. The electric generator is composed of two hollow drums of idio-electric material, of which the smaller is arranged air-tight within the other, and both arranged to rotate around a common axle, but in opposite directions. For description see THE ELECTRICAL WORLD, July 14, 1888.

401,191. Electric Meter; Albert H. Manwaring, of Philadelphia, Pa. Application filed Aug. 25, 1888. The combination, in an electric meter, of a compound magnet energized by the main or lighting current, and a series of register-operating armatures controlled by said magnet and offering a graduated resistance to the attracting power thereof, the retracting device of each armature being independent of those of the other armatures.

401,221. Electric Railway; Sidney Howe Short, of Denver, Colo., Assignor to the United States Electric Company, of same place. Application filed Feb. 17, 1887. It is the object of the invention to provide, in connection with the conductors of a series electric road, means by which the main and return wires may be placed in parallel with one terminal of the generator and the track in connection with the other terminal, with electrical connections from the rails of the tracks to the motor, and from the motor to the conductors of the series system, whereby the cars during a break in the circuit may be run in multiple arc upon either side of the break.

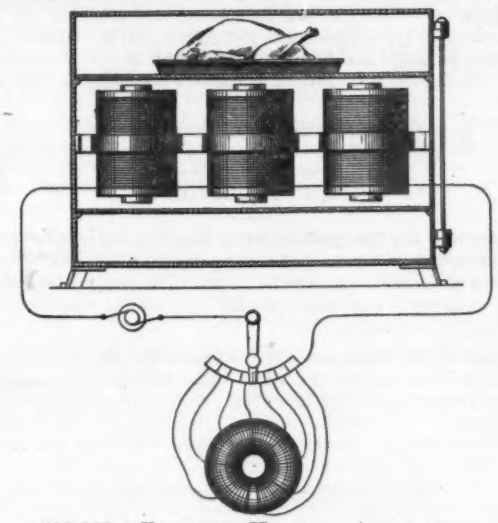
401,226. Electric Meter; Walter F. Smith, of Philadelphia, Pa., Assignor to the United States Electric Improvement Company, of Gloucester City, N. J. Application filed Aug. 22, 1888. See page 228 for description.

401,227. Mechanical Telephone; George Thomas, of New York, N. Y., Assignor of one-third to Joseph H. Simpson, of same place. Application filed Oct. 15, 1888. A diaphragm for transmitting and receiving sound, composed of leatheroid and tin.

(1) 401,230. Regulator for Dynamo-Electric Machines. (2) Reciprocating Electric Engine System; Charles J. Van Depoele, of Lynn, Mass. Applications filed (1) August 22, 1888; (2) January 21, 1889. The combination of a generator having two armatures, one of which is included in the main working circuit, the other in circuit with the field magnets of the generator and a motor for adjusting the commutator brushes of both armatures, comprising a solenoid included in the main circuit and arranged to lower or raise the said commutator brushes according to the rise or fall of potential arising from increased or diminished demand for current in the main circuit. (2) The invention comprises means for producing defined current phases of the desired volume and intensity and with only the required rapidity, said currents being transmitted to the motor coils (producing reciprocation) by separate circuits, so that with a generator adapted to produce defined currents with only the desired rapidity and circuit connections for transmitting said currents to the proper working coils no circuit-breaking, changing or shifting of any kind whatever occurs.

401,244. Splicing Device; John Conrad Basel, of Galveston, Tex. Application filed Oct. 15, 1888. The combination, with the adjacent ends of two wires bent so as to interlock of a casing, surrounding said ends and having its ends bent in.

401,255. System of Transmitting and Distributing Electricity; Stanley C. C. Currie, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester City, N. J. Application filed Aug. 23, 1888. The method of distributing and transmitting electricity, which consists in producing two or more currents of low electromotive force, transferring such cur-



400,978. ELECTRIC HEATING APPARATUS.

rents at intervals of time to reservoirs disconnected from the generator-circuits, again transferring such currents to reservoirs connected with a main line, and finally combining the said currents to form a current of high electromotive force, and conveying the said current over said main line.

401,270. Switch or Circuit Changer; William W. Griscom of Haverford College, Pennsylvania, Assignor to the Electro-Dynamic Company, of Philadelphia, Pa. Application filed June 30, 1888. The combination, in a switch or circuit changer, of two pieces of conducting material respectively pivoted at points midway between their extremities to reciprocating bearings and normally held in contact at two points by spring pressure, with a plug or wedge consisting of two strips or conductors, insulated from each other and adapted to successively separate said two contact points by a continuous advance movement.

(1) 401,289. Secondary Battery. (2) 401,291. Process of Preparing Electrodes for Secondary Batteries. (3) 401,290. Secondary Battery; William Main, of Brooklyn, N. Y., Assignor to the River and Rail Electric Light Company, of West Virginia. Applications filed Jan. 10, 1889. (1) A secondary battery, the hydrogen pole-piece whereof is composed in whole or in part of zinc, and wherein mercury is present either in solution or as a constituent of the hydrogen pole-piece, the plates of which battery are in close proximity and horizontally placed, one or more of the hydrogen plates being immediately below an oxygen element, said horizonal disposition facilitating the even distribution of precipitated metal upon the hydrogen-plates and preventing the accretion upon the hydrogen-plate of short-circuiting formation. (2) The process of preparing a secondary battery pole-piece, which consists in subjecting a layer of granulated zinc to the action of an electrical current in an electrolyte and in the presence of mercury, thus causing a spongy formation of the zinc and mercury upon the granules of said layer. See illustration. (3) In a laminated secondary battery element, two or more layers of material active in the battery, having between them a layer of carbonized cloth or other fabric.

401,296. Electrical Call Bell; Joseph Gillet Noyes, of New York, N. Y., Assignor to the New Haven Clock Company, of same place. Application filed Dec. 17, 1888. The invention consists in the combination, with a signal magnet and its core of a single armature perpendicular to said core, a clapper on said armature, and a bell to be struck by said clapper.

(1) 401,317. Dynamo or Magneto-Electric Machine. (2) Dynamo-Electric Machine; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Company, of New York, N. Y. Applications filed (1) May 31, 1881; (2) Oct. 24, 1882. (1) In an armature whose core is longitudinally wound with a continuous conducting coil or coils, a coil composed of longitudinal conducting-bars combined with cross connecting discs or plates. (2) The conductors or coils are applied to the core in such manner that the former will be separated from the core so as to leave air-spaces entirely around them.

401,322. Apparatus for the Application of Electricity to Propel Vehicles; Frank Wynne, of Westminster, County of Middlesex, England. Application filed June 6, 1887. Patented in England, July 15, 1886; in Germany, Jan. 27, 1887; in France, March 9, 1887; in Belgium, Sept. 2, 1887; and in New South Wales, Oct. 4, 1887. In apparatus for the application of electricity to propel cars or vehicles, the combination, with a pipe or covered channel, of stationary insulated contact studs or rivets having parts exposed in the road along which cars or vehicles are to be electrically propelled and parts exposed in said channel, said contact studs or rivets being so arranged that said exposed parts are short and frequent in the direction of said road but not in close proximity.